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TE HAERENGA WAKA

**POLYNESIAN ORIGINS, MIGRATIONS,
AND NAVIGATION**

Rawiri Taonui

A Thesis submitted in partial fulfilment of
the requirements for the degree of Master of
Arts (Hons) in Maori Studies.

UNIVERSITY OF AUCKLAND

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ABSTRACT

I put aside my fears. They had faith in the words of their fathers. This is what we call courage. With this courage you can travel any where in the world and not get lost. Because I have faith in the words of my ancestors I am a navigator. I learned these words when I was a young boy in my father's canoe.

Mau Piailug, Navigator from Satawal, 1972.

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ABSTRACT

This thesis investigates Polynesian origins, migrations, and navigation. The main issues it examines are the questions of where the ancestors of the Polynesians came from, and how they managed to settle the islands of Polynesia. The second question is itself twofold. Firstly there is the matter of the sequence and time that settlement occurred, and secondly there is the debate about whether or not settlement occurred as the result of accidental or deliberately navigated voyages.

Before beginning this project I had no experience, expertise, or knowledge in the fields of astronomy, archaeology, ethnobotany, ethnozoology, navigation, Pacific meteorology, and Polynesian geography. Nor was I familiar with the oral traditions of the islands of Polynesia, or the records of early European observers in the Pacific. My sole preparation was that I had some experience in researching Maori tribal tradition. I endeavoured to learn as much as I could beginning in March 1994, and also hoped that I could produce a thesis before February 28th 1995.

The strength of this thesis is that the research was undertaken in some depth. This was thought necessary for two reasons. Firstly the writer wanted to know and understand everything, and secondly it was thought that in the past other writers had displayed a tendency to make selective use of the evidence. This is particularly evident in the treatment of the records of early European observers in the Pacific such as Cook, and in the way evidence has been used from the Polynesian oral traditions.

Unfortunately, given the time constraint a disproportionate amount of time was spent on research in relation to the time devoted to analysis. And, although the writer feels that there is some merit in the way the evidence has been considered, especially with regard to the oral traditions, there is no doubt that more time would have been fruitful. However, we all have crosses to bear and mine is to graduate in 1995. I completed my last piece of research on February 8th.

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Ka mihi ki te mano ki te tini kua mene ki te po.

Haere koutou ki runga i nga ara ki Haumu, ki Te Waingunguru, ki Herangi. Whakawhiti i Waitarau, piki ake i Te Atuaperunui, taiheke ki Te Rerenga Wairua. Ki reira heke iho i Te Waioraropo, i Te Waiorata, i nga akaaka i huaina e nga tupuna ko Rehia.

Haere koutou ki Ohau, tangitangi mai. Hoesa oo koutou waka i Hawaiki tautau mai, ki Hawaiki tautau atu, ki Hawaiki runga, ki Hawaiki raro. Haere koutou ki te hau o Kupe, ki Te Tokerau, ki Te Tonga. Ka pahure koutou i nga whare o nga uri o Tangaroa, o Hine moana. Ka huri ki tua o pae, ki te rua o Tama-nui-i-te-raa.

Piki ake i te aratiatia, i pikitia ai e Tane-nui-a-rangi ki ngaa Rangituhaha. Haere ki Te Rangihauapapa, tatau o Tawhirirangi, i te pumotomoto o te kauwhanga o Te Toi-o-nga-rangi. Ki reira, hoki mai ma runga i Te Paepae-o-Mahutonga, i Te Paepae-o-Rehua, i Te Paepae-o-Kuku. Titiro iho mai hei awhina, hei manaki, hei arahi i a matou.

Waiho ake ratou kua whakawheturangitia ki a ratou, tatou nei nga waihotanga mai o ratou, tatou e hapai nei i o ratou wawata,

tumanako hoki, tena koutou, tena koutou kiaora tatou.

I would like to acknowledge Dr. Ranginui Walker for supervising my thesis and for his support and assistance during the course of my studies. I also thank Dr. Jane McRae for her valuable assistance with the editing. I would also like to recognise other academic staff such as Dr. Pat Hohepa, Waerete Norman, and Dr. Steve Webster for their support, advice and encouragement. Doug Sutton and Geoff Irwin also helped guide me with reference to specific material regarding archaeology and navigation. I also thank 'Team Hokianga', being Pauline Hopa, Rapata Wiri, Pene-ani Kupenga-Keefe, Garrick Cooper, Nanaia Mahuta and Rawiri Walker who helped with the proof reading and graphics. I also make special mention of Hineira Woodard whose assistance in 1993 allowed me to complete a full time year.

It is also appropriate to acknowledge several of my fellow students. The first I would like to mention is Rapata Wiri whose three year endeavour with his thesis set a new bench mark and example for the rest of us to aim at. In the past Maori Studies has had problems supporting its post graduate students, and those completing M.A. and PhD. are generally few and far between. This year I expect to graduate alongside Nanaia, Jennifer, Rapata, Jeanette, Chris, Aunty Waerete, and perhaps one or two others. Although this is a credit to the renewed vigour within our department, it is also a credit to the character and perseverance of our graduates, most of whom have worked with minimal assistance.

Most of all I would like to acknowledge Riley and Babara Thompson, Pauline, Otene and Marcia Hopa, Garrick Cooper, his mum and Werahiko whose aroha in looking after Rawiri-nohinohi and myself proved to be the most valuable benefaction we received. They epitomise 'really choice cussies'.

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List Of Abbreviations

50,000BP	50,000 years before the present.
1350BC	1,350 years before Christ.
1200AD	1,200 years after Christ.
12GB-1900	Twelve generations before 1900AD.

CONTENTS

INTRODUCTION

A MESSAGE TO READERS

The Journal of Management is a leading international journal in the field of management. It is a multidisciplinary journal, publishing research from a wide range of disciplines, including economics, psychology, sociology, and anthropology. The journal is published quarterly, and is available in both print and electronic formats. The journal is indexed and abstracted in a number of major databases, including the Social Sciences Citation Index, the Social Sciences Index, and the Social Sciences and Humanities Index. The journal is also available in a number of languages, including English, French, German, and Spanish.

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INTRODUCTION

A SUMMARY OF ISSUES

For more than 200 years there has been debate about the origins of the Polynesians, their settlement of the Pacific, and whether or not they were capable mariners. Essentially there are three main issues in that debate: the first is, where did the ancestors of the Polynesians come from, the second, what was the time frame and sequence of their settlement of the Pacific Basin, and the third, whether or not settlement was achieved by deliberate or accidental voyaging.

A fivefold comparative approach is taken in this thesis to address those questions. Firstly archaeological evidence is considered in order to address the question of Polynesian origins, and the sequence and time frame of their migration through the profusion of islands in Polynesia. The second body of evidence considered, concerns the historic debate pertaining to navigation. Up until the mid-1960s the main body of evidence considered during the course of this debate was that taken from the records of early and post-contact European observers in the Pacific. The third constituent body of material is the more recent empirical data obtained by the construction and sailing of modern Polynesian double-hulled canoes. Attached to this is a summary of the predominant weather patterns in the Pacific. The fourth consideration is a summary of Polynesian oral traditions concerning the migration and movement of their peoples and canoes about the Pacific Ocean. A fifth body of evidence combines a summary of the Polynesian Navigation System with a brief overview of the design and construction of deep-sea voyaging canoes. By

investigation and assessment of these five bodies of evidence it is hoped to add a new perspective on the debate over Polynesian origins, migrations and navigation.

An Ethnohistorical Review

Part One of this thesis summarises the debate about the origins of the Polynesians and their navigational ability. Chapter One reviews the archaeological literature concerning Polynesian origins and addresses the following questions: Where did the Polynesians come from, when did they arrive, how long did it take to settle the islands of Polynesia, and, in what sequence did these events occur? Aspects of linguistics, ethnobotany, ethnozoology, and biological anthropology are also considered. Howard's (1967) Polynesian Origins and Migrations: A Review of Two Centuries of Speculation and Theory, Te Rangi Hiroa's (1945) An Introduction to Polynesian Anthropology, and Green's (1994) Changes over Time - Recent Advances in Dating Human Colonisation of the Pacific Basin Area provided invaluable summaries of the early literature and archaeological evidence and were the main sources for this chapter.

Much of the early historical debate was conducted within a climate of crude archaeology, romantic associations of culture, word association, the rearranging, reconstruction and reinterpretation of Polynesian oral tradition. Social Darwinism and Christianity heavily influenced the discourse. Many such as Brown (1907) in his Maori and Polynesian: Their Origin, History and Culture based their work on the theories of Social Darwinists such as Lewis Henry Morgan (1878), who in his Ancient Society stratified the racial divisions among the human species from black at the bottom to white at the top. Brown Polynesians fell somewhere in between and argument abounded as to whether this meant they were Caucasians who had fallen from grace, or darker stock nobly ascending the evolutionary ladder. The argument about origins also influenced the debate about navigation. Some Social

Darwinists believed that the lighter races were not only more advanced in evolutionary terms, but also more intelligent. Of course this also meant asking whether or not the Polynesians were sufficiently advanced enough to have made their way across the expanse of the deep Pacific Ocean in an intelligent way. Some accepted that they had and others such as Heyerdahl (1951) in his Voyaging Distance and Voyaging Time in Pacific Migration could not. According to the supporters of the latter position, if after a few hundred years of experimenting, the European had only recently perfected deep sea navigation then the darker racial types could not of managed it before them, simply because that would be evolutionary heresy. For them the Polynesian had arrived like ragamuffins on rafts at the behest of the elements.

Christianity also played its role with many such as Abraham Fornander (1878) in his An Account of the Polynesian Race, and Samuel Marsden (1932) in The Letters and Journals of Samuel Marsden, wanting to prove that the Polynesians were descendants of one of the twelve lost tribes of Israel, or the offspring of Noah, Jacob and Achsah, or though by all accounts she was barren. The Mormons had their own fancy. At least Polynesians were not cast as Philistines.

As the debate matured most commentators were able to recognise that strong connections existed toward South-East Asia.¹ Others noted that the kumara came from the Americas, and that the prevailing weather came from that direction also. The Americas position received favour from some like Thor Heyerdahl (1952) in his American Indians in the Pacific, because many could not accept that the primitive Polynesians were possessed of the skill, knowledge and hardware, to have been able to deliberately sail from the east into Polynesia against the prevailing winds and currents. Instead they preferred that they were borne forth at the whim of weather and wave. Fortunately the speculations of the early theories were rebutted by advances in linguistics,

¹ See Hiroa (1945), Howard (1967) and Green (1994).

archaeology, and biological anthropology from about the 1950s onward. New data indicated a clear origin area within Near Oceania, and the probability of some lesser contact with the American continents. Progressively, others realised that there were no Polynesians until some time after pre-Polynesian ancestors arrived in Polynesia, and had proto-Polynesian descendants who eventually became Polynesian. With these advancements came further research about the precise time of arrival and an increased understanding of the likely pattern of subsequent dispersal and migration. More recent archaeological evidence shows that the pre-European Polynesians and their ancestors maintained extensive trading networks over hundreds of sea miles. It seems that as these trading networks expanded, and as navigational technique and technology increased, gradually some ventured forth and settled new island groups. New networks were formed. The gradual easterly progression of these trade networks marks the progressive settlement of island Polynesia.

Chapter Two traces the parallel debate about Polynesian navigation, and whether or not the Polynesians were capable navigators. Sharp's (1956) Ancient Voyages in the Pacific, Golson's (1962) Polynesian Navigation: A Symposium on Andrew Sharps Theory of Accidental Voyages, Irwin's (1992) The Prehistoric Exploration and Colonisation of the Pacific, and Walker's (1994) Lecture on Polynesian Navigation provided the most useful summaries for the material in this chapter. Historically this debate has swung between two positions. One promoted Polynesian navigational ability without proving it, and the other dismissed it in the absence of any proof. Few sought to find any hard evidence one way or the other. Virtually no empirical evidence existed. The issue was further complicated by romantic notions about the Polynesians crossing the Pacific Ocean in the manner of intrepid Vikings roaming the North Sea. No proof was offered in support. Fortunately there were cynics who were more than willing to attack the romantic view. However, their position was often problematic, frequently being based on ethnocentric common sense which conveyed to them the obvious

impossibility of it all.

The argument reached a new acme with the publication of Sharp's (1956) Ancient Voyages in the Pacific, in which he launched a brilliant, albeit vitriolic polemic against the romantics. His devastating attack effectively shattered the dreams of the romantics, except for those who chose to ignore it and remain under the covers. Although Sharp acknowledged that Polynesians had some ability he limited it to short-range voyaging between islands of a few hundred miles. He argued that over longer distances bad weather, current set, and wind drift, caused canoes to become lost. He further stated that this was how the 1,000 mile gap between West and East Polynesia was crossed, and indeed, how Polynesia was largely peopled. The response was swift with many pointing out that his arguments were often ill-founded and his use of the evidence selective. Unable to resist the temptation many also pointed out that he had never been sailing. Few mentioned that neither had they. Nevertheless, the merit of his attack was that its logic stimulated academic study of Polynesian navigation. At this stage neither Sharp's position, albeit very logical, or that of the romantics, was backed with hard empirical evidence.

As the debate moved into the mid-1960s it was largely fuelled by the extensive analysis of the records of early European explorers, missionaries, and traders in the Polynesian triangle. The analysis of these records was exhausted within a few years. The results as outlined in Golson's (1962) Polynesian Navigation: A Symposium on Andrew Sharp's Theory of Accidental Voyages, and Finney's (1976) Pacific Navigation and Voyaging tended to favour the position that Polynesians had a high degree of navigational skill. It came to be understood that they knew well how to navigate by observation of the stars, winds, currents and waves. They were also able to read various land indicating signs such as changes in bird life, debris, and cloud formations. Interestingly, the evidence also showed that a high incidence of drift voyaging did occur although many of the seafarers were

recorded making deliberate return voyages. Unfortunately, this kind of evidence was used fairly selectively by both sides in the debate. More empirical evidence was required.

The purpose of the detailed analysis in these chapters is that they provide a foundation against which material from the modern voyages, as discussed in Chapters Four to Eight, and from the oral traditions, as discussed in Chapters Eleven to Thirteen, can be compared.

The Renaissance

Early in the debate promoted by Sharp's theory of drift voyages, some of his opponents thought that it would be more than useful if they went out and found some Polynesians, or other Pacific Islands people, who knew how to sail without instruments. This marked a shift in the debate from the theoretical to the empirical. Lewis (1975) We The Navigators, Gunn (1980) Etak and the Ghost Islands of the Carolines, and others located a number of Micronesian and Polynesian navigators sailing without compasses or other instruments. In an empirical sense, traditional methods of navigation were finally discovered.

Others were equally inspired and decided that perhaps they too could emulate the feats of Polynesian navigators. From 1965 to the present, several voyages using traditional methods and maritime technology have been made. Several of these voyages are summarised in Part Two. Chapter Three of this section contains an analysis of the predominant weather patterns and their major variations in the Pacific Basin. The summaries by Finney (1991) A Two Year Voyage, and Irwin (1992) in The Prehistoric Exploration and Colonisation of the Pacific proved most helpful. This chapter has been included simply because the unique patterns of Pacific weather, in conjunction with its geography, played a major role in the timing and manner in which all of Polynesia was settled. For example, the predominant easterly winds and

currents, and the lack of islands within 2,000 miles of the coasts of the Americas, argues strongly against the possible evolution of deep sea navigational lore on the shores of those continents sufficient to settle Polynesia. Any early canoe venturing off the eastern sea boards of the Americas would be blown deep into the Pacific with little hope of making a return. However, the easterly trends favour the evolution of voyaging in Near Oceania into and across the head winds simply because early mariners were safe in the knowledge that if they got into problems they could turn about and return home in a third of the time it took them to venture east. The end of the Chapter includes a further analysis of possible voyaging routes claimed in traditions. It is important to note that in the past, few of the romantics had considered whether or not the voyages they liked to think occurred were ever possible in this regard.

Lewis's 1965 voyage in the *Rehu Moana* from Rarotonga to New Zealand marked the beginning of the renaissance of Polynesian voyaging. The purport of these modern voyages was that they demonstrated, with some ease, that traditional non-instrumental methods of navigation were more than adequate for voyaging far beyond the 300 mile limit set by Sharp. Within ten years of the renaissance, voyages of more than 3,000 miles were being made. The voyages of the modern era have also gone some way to validate migratory routes claimed in tradition. Possibly the most impressive was the Voyage of Rediscovery undertaken by the *Hokule'a* from 1985 to 1987. During that voyage the *Hokule'a* sailed from Hawai'i to Tahiti, then on to New Zealand, then to Tonga, Samoa, back to Tahiti and finally to Hawai'i. Several good summaries of these voyages have been used by the writer. Those sources that proved to be of most value were: Lewis (1966) Stars Of The Sea Road, Babayan et al (1987) Voyage to Aotearoa, Finney et al (1989) Wait For The West Wind, Finney et al (1991) Voyage of Rediscovery. Greg Whakataka-Brightwell's (1994) unpublished manuscript and personal communications provided much valuable information on the 1985 voyage of the *Hawaikinui* about which very little is currently known. Crew members from *Te Aurere's* 1992

voyage to Rarotonga were also interviewed.

These voyages proved the reliability of Polynesian seafaring methodology. The voyages in Chapters Four to Eight are scrutinised in some detail. It had been the writer's observation that pro-navigation writers have often over emphasised the positive aspects of these voyages, and either minimised or ignored any areas of contention. For example, during the voyage of the *Rehu Moana*, highly accurate latitudinal readings were frequently made through astronomical observation and these have been frequently quoted. However, the exact positional estimates were often greatly in error. Similar problems characterised the voyages of the *Hokule'a*. The difficulty is that latitudinal readings do not give the full picture. If a canoe is at zero degrees latitude, then it is on the equator and possibly at any point along the several thousands of miles that the equator spans the Pacific. The navigators of the modern era frequently made longitudinal estimates that were greatly in error. Errors of 100 miles were not unusual. However, because of the tendency of most of the errors to cancel each other out over long voyages, the high degree of accuracy of latitudinal readings, and the appearance of land signs, the position errors characteristically decline toward the end of the voyage. It would seem that this was a feature of Polynesian voyaging.

There is also a concern about the utilisation of modern materials in the construction of the contemporary canoes. This raised the question about the durability of ancient canoes in the deep sea. The voyage of the traditionally constructed *Hawaikinui* from Tahiti to New Zealand in 1985 went some way to answering that question. Interestingly, the performance of this canoe under extreme duress, and its condition upon landing, confirm much about the preparation and construction of canoes that is mentioned in the traditions. Other concerns surround some of the navigational aids known to have been on some vessels. For example, satellite navigation systems and an outboard motor are permanent fixtures aboard the *Hokule'a* and *Te Aurere*. Although

the integrity of the Polynesian Voyaging Society in Hawai'i is not questioned, it is unfortunate that the presence of these things lacks mention in many of their published works.

Polynesian Oral Tradition

As the debate has moved on into the 1980s and 1990s, detailed analysis of the oldest standing body of evidence remained largely untouched. This is because Polynesian oral traditions regarding their origins and canoe migrations, do not sit easily within the academic conventions of reliance on written records. Early romantic treatment of oral traditions from Hawai'i by Fornander (1878-1885) An Account of The Polynesian Race, and from Rarotonga and New Zealand by Smith (1898, 1904, 1910, 1921) Hawaiki, distorted the traditions by their interpretations of them. The value of the traditions was further undermined by the extreme alteration of much of their content. Although the tendency has been to blame Europeans for these reconstructions of the traditions, it is equally true that several indigenous persons delivered material they had already altered themselves into the hands of those eager to record new material and reveal the grandiloquent. The nineteenth century manuscripts by Te Whatahoro from New Zealand, Te Arikitarare from Rarotonga, and the work of Kepelino and Kamakau from Hawai'i are cases in point.²

This situation was aggravated by the uncritical collection of traditions by some ethnographers without cross referencing them against other traditions, recording the source, or even the status of their informants. Others such as Best (1925b) The Maori Canoe, and Hiroa (1949) The Coming of the Maori, were also too willing to accept the theories of Smith and Fornander without sufficiently questioning what they were reading. This stance also gave rise to a popular opinion that accepted almost anything in

² See Simmons (1976) The Great New Zealand Myth, Barrere (1967) Revisions and Adulterations in Polynesian Creation Myths, and Chapter Ten of this thesis.

the literature claimed as being genuine tradition. Unfortunately many indigenous Polynesians had lost much of their traditions and nearly all of their pre-European schools of learning had been disbanded for several decades. The works of Smith, Fornander and company were published at an opportune time and filled that particular gap. That those works were so readily accepted stemmed from the desire to accept what was wanted to be believed rather than a desire to seek the truth.

Part of the problem also lies with the nature of oral tradition itself. Scarr's (1990) The History of the Pacific Islands describes oral tradition as having an inbuilt tendency to vary according to need, delivery and occasion. Furthermore, traditions may be reworked to accommodate new information. Certainly no oral tradition remains intact word for word over hundreds or thousands of years. To think that, is to enter the mythical realm of pure fancy. This adaptive variable aspect means that tradition also has a tendency to absorb new information. In the current writers view these two factors, coupled with the arrival of the European, caused a rapid increase in the rate at which new information was assimilated, especially into the prose narrative. It is also likely that changes occurred as a reaction to intellectual hegemony whereby Polynesian people were being constantly reminded that they were primitive savages, and that Europeans knew better where they had originated. It is no coincidence that for every fictional theory postulated by the Europeans during the nineteenth and twentieth centuries, there is now an equal in 'genuine tradition'.

The three main altered bodies of tradition are those from Hawai'i, Rarotonga and the lower East Coast of the North Island of New Zealand. These traditions are dealt with by comparison with changes in Polynesian creation myths as outlined in Barrere's (1967) Revisions and Adulterations in Polynesian Creation Myths. Her work on the creation myths is used because of its clarity and the fact that the changes are patently obvious.

Eventually most of the reconstructions were exposed in works such as Sharp's (1956) Ancient Voyages in the Pacific, Emory's (1968) Origin of the Hawai'ians, Orbell's (1975) The Religious Significance of Maori Migration Traditions, and her (1985) Hawaiki: A new Approach to Maori Tradition, Simmons (1976) The Great New Zealand Myth, and Sorrenson's (1977) The Whence of the Maori, and his (1979) Maori Migrations: The Genesis of Some Pakeha Myths and Legends. These works have done a service in unscrambling the traditions and bringing them back into focus within their own cultural setting. Hopefully works such as these have put paid to that particular intellectual debacle.

From the mid-1950s onwards the scholarly reaction to the reconstructions has become more dismissive. As a consequence of the difficulties of establishing the veracity of oral tradition, some writers dismiss them as too problematic. Unfortunately, the negative reaction has tended to be more severe than is warranted. Subsequent analysis of Polynesian oral tradition has been sparse. This cautious attitude has also been influenced by other early writers such as Colenso (1868) The Maori Races of New Zealand. Their prejudicial attitudes dismissed Polynesian orality as fiction. The dilemma now is that there is a real hesitancy about how traditional material should be analysed. These issues are outlined in Chapter Nine. The analysis is detailed because of the writer's view that the traditions are useful in understanding pre-history, especially when used in conjunction with archaeology, linguistic analysis, and other objective techniques for reconstructing the past.

Other issues are highlighted, the first of which is Biggs' (1966) Maori Myths and Traditions, and Walker's (1976) The Relevance of Maori Myth and Tradition, restrictive view that the facts of mythology are beyond verification. Their dismissal of the Maui and Tawhaki myths as not being concerned with real people and Polynesian migration is thought by this writer to be pre-emptive in an area lacking in research. It is the writer's belief that those cycles of myth probably contain some historical references

relevant to Polynesian migration and voyaging. However, once the point is made, it is left. Unfortunately, proving that these particular myths were based on real events is beyond the bounds of this thesis. The primary focus is therefore on those traditions more clearly associated with settlement, migration and voyaging.

When analysing traditions, it is important to appreciate their value while being aware of the pitfalls. It is true that the boundaries between myth and tradition are blurred and that each contains elements of the other. Both contain aspects of real events and moral truths adhered to by the owners of the stories. The task is to decipher those realities and truths from the myths and traditions. Despite the problems of analysis, there is a certain consistency among the Polynesian traditions from the Outliers, West and East Polynesia that is too apparent, and too difficult to dismiss as having no foundation in truth. This consistency is twofold. Firstly they are consistent in a structural sense. Those islands with larger populations have sustained longer genealogical records of real events. Those with smaller populations have not. The earliest genealogies tend to be rather singular and descend into a broadening pyramid shaped genealogical matrix. This matrix consists of an increasing number of individuals whose relationships are interlocking and consistent. In this sense they are also checkable. The traditions are also consistent in what they say. Nearly all the islands have traditions about the first most well remembered arrivals, who settled after the original occupants, about whom very little is known. The traditions also speak of initial close quarter zones of contact with their immediate neighbours or within their own island groupings. Less frequent mentions are made about voyages over very long distances.

Chapters Ten to Twelve deal with a large amount of the evidence from the Polynesian oral traditions. Some care has been taken to validate as far as possible the reliability of sources, informants and manuscripts. Island location and isolation,

population densities, and European arrival have been noted as indicators of how much tradition has been retained. For example, the later; contact with Europeans, especially missionaries, the lesser the amount of reconstruction of the traditions. In respect of the traditions of the Polynesian Outliers, West and East Polynesia much reliance has been placed on several of the Bishop Museum Bulletins published in Honolulu. The Bishop Museum conducted several ethnographic expeditions around the islands of the Pacific during the course of this century. Generally speaking the recording of traditions in these bulletins appears to have been achieved with a good awareness of the pitfalls. Notable among those works are Te Rangi Hiroa's (1932) Ethnology of Tongareva, (1932b) Ethnology of Manihiki and Rakahanga, (1934) Mangaian Society, and the (1938) Ethnography of Mangareva. His works are not only useful for the information they record but also for his treatment of oral tradition generally. In respect of the traditions from New Zealand much reliance has been placed on the painstaking work of Simmons' (1976) The Great New Zealand Myth. Unfortunately few original sources were accessible to the writer, therefore most of the information has been gleaned from secondary sources. The wide scope of the research has also meant that insufficient time was available to research other aspects of tradition beyond the narrative prose and genealogical recital.

A common feature of the traditions of the islands of Polynesia is the paucity of information about the original inhabitants. Most of them refer to characters inhabiting the spiritual twilight such as fairies, ogres or spirits. These traditions are followed by those about subsequent, most well remembered ancestors and are usually referred to as 'first arrivals'. Following this, other arrivals and departures are mentioned. Genealogically, the traditions have a reliable depth of up to thirty to thirty-five generations before 1900AD. Beyond that some figures may be real but their precise genealogical position is uncertain. Some of the traditions yield considerable information about the origins of first arrivals and about inter-island voyaging.

The traditions generally describe zones of frequent contact up to about 500 miles distant. This accords very well with the archaeological evidence outlined in Chapter One, and with the European records summarised in Chapter Two. They also speak of longer voyages up to 1,000 miles, and those between Hawai'i and Tahiti of more than 3,000 miles. The impression given is that long distant voyaging was neither impossible or necessarily difficult. However, longer voyages were not attempted unless very good reasons existed for doing so. Long voyages were not undertaken lightly. Traditional canoes were valuable commodities that took time to construct. Their lashings, sails and other materials took a beating over long voyages. A desire to avoid that kind of stress on the vessel seems strong. There were also constraints of human endurance, food, and water. Secondly, many ocean voyages in Polynesia can be accomplished by sailing from one island to another intermediate to the destination, rather than by direct route. Stops enroute allow for refitting and replenishing of provisions. They are also safer.

Navigation Systems and Waka Design

Chapter Thirteen of Part Four presents a comprehensive summary of The Polynesian Navigation System. It begins with a brief explanation of the likely evolution and development of navigation. Irwin's (1989) Against, Across and Down the Wind: A Case for The Systematic Exploration of The Remote Pacific Islands, and his (1991) The Prehistoric Exploration and Colonisation of the Pacific provided the best summaries for this.

The chapter then offers a synthesis of navigational methodology based on what has been learned from the experiences of the modern Polynesian navigators, the empirical era of research and from the traditions. Lewis's (1972) We, The Navigators, Lindo and Mower's (1984) Polynesian Seafaring Heritage, Sneider and Kyselka's (1986) The Wayfinding Art. Ocean Voyaging in Polynesia, and Finney's (1991) unpublished Voyage of Rediscovery, proved to be

the best sources for this information. Paradoxically much of what is now known is also confirmed in the recorded observations of early Europeans in Polynesia. The difference now is that much has been confirmed by experience. The Polynesian Navigation System rests upon the tenet that at any one time there is a variety of phenomena in nature upon whose observations certain logical deductions can be made to set course, navigate at sea and find land.

In support of the previous chapter on navigation techniques, Chapter Fourteen summarises various design and construction aspects of Polynesian double hulled canoes. Some comparisons are made with Micronesian canoes in an effort to highlight specific features of the Polynesian canoes. Lewis's (1972) We, the Navigators, and his (1994) We, the Navigators: The Ancient Art of Landfinding in the Pacific, along with Hunt and Kelly's (1984) Double Hulled Canoes of Oceania, proved to be very useful summaries. All these works include material collected by early European observers in the Pacific, and from twentieth century ethnographers who recorded much material. Recent knowledge gained during the modern renaissance of canoe building and navigation is also included.

Chapter Fifteen then presents a summary of the particular debate surrounding the motivation for long distance voyaging. The stance taken in this thesis is that trade and economics were the main motivating factors for exploratory voyaging and initial settlement. Contrary to other views an increase in population is perceived as contributing to the decline in voyaging.

Summary

This thesis presents a broad ranging synthesis of material firstly from archaeology, linguistics, ethnobotany and biological-anthropology, secondly from the historical record of the debate over navigation, thirdly from the era of modern

Polynesian voyaging, fourthly from the Polynesian oral traditions, and fifthly with regard to the techniques and technology of navigation.

Each of these fields of discipline are reviewed separately and without any conscious effort to make specific conclusions other than what is suggested by the evidence. However, it is noted that there is a convergence of the evidence from these disparate but related fields.

The consideration of the traditions in this thesis is broad in scope. Except for the reconstructions promoted by Smith and Fornander there are no other comprehensive summary of such a wide range of Polynesia canoe traditions in the literature. The significance of the review rests on the evaluation of Polynesian oral traditions on their own terms, combined with comparison with other material and visa versa. Every attempt has been made to validate tradition in terms of its pre-European content. It is accepted that tradition is variable and did not exist in some pristine unchanging state. The argument used is that the traditions from many separate islands in the Polynesian Outliers, West and East Polynesia are highly consistent in what they say about settlement, inter-island contact and the extent of deliberate voyaging. All too often aspects of the traditions are quoted in support of different positions in the arguments over navigation and migration. Such is the case with the sailing directions to New Zealand said to have been left by Kupe. Few other writers have attempted to track down the sources of many of the traditions they quote and then subject them to scrutiny. In this thesis an attempt has been made to show that this is a worthwhile undertaking. This thesis reappraises the traditions by cross-referencing them against each other.

Sutton's (1994) The Origins of the New Zealanders has shown that there is already an increasing awareness that much of what is said in the traditions is probably feasible and to some degree in accordance with what is being discovered in the archaeological

record. Despite this progress, the business of correlating archaeological records and oral tradition needs to be treated with caution. There are pitfalls, not the least of which is the hasty acceptance of the congruences solely on the basis of a prima facie inspection of evidence. An attempt at summarising this convergence is made in the conclusion.

This dissertation also tries to broaden the horizon of the inquiry by posing other questions. Some that are addressed are: Why did Polynesian navigation decline in some areas, why did it cease in others before European arrival, and what motivated Polynesians to seek out new lands? The popular answer to the latter is over-population. However, the traditional evidence suggests that more long distance voyaging occurred when populations were lower, unless forced by expulsion or defeat. Piracy, raiding and trade seem the likely other motives.

In summary it would seem that Polynesians were capable seafarers whose ancestors arrived from the east some 3,500 years ago and who over about 2,000 years managed to sail to nearly every rock, atoll and island in Polynesia. They may well have touched other shores. The Americas are a likely candidate for that, at least once, if not on several occasions. It is likely that the safety parameters were broad enough and the methods accurate enough for very long voyages to be accomplished. Certainly anything between 300 to 500 miles was probably frequent. No doubt drift voyages did occur and lives were certainly lost. But the traditions also indicate that, many drift voyagers also had the ability to make return voyages to their home island after refitting their vessels. This is also supported by the records of early Europeans and the traditions. Large sailing zones of contact and trade existed. This is supported by the archaeological evidence and oral tradition. Most exploration and migration probably occurred as an extension of these zones. New zones formed and old ones disappeared. From 1500BC to 1000AD all of Polynesia had been reached.

CHAPTER ONE

THE ORIGINS OF THE POLYNESIANS

Since the time Europeans first entered the Pacific ocean there has been debate about the origins of the peoples they found living there. This debate includes how long they had lived there and whether or not their settlement of the Pacific was by deliberate colonisation, or alternatively, the result of accidental migration over a period of many hundreds or thousands of years.

The Historical Debate

In regard to the Polynesians, there have been two main schools of thought, one proposing that they originated from the west and the second that they came from the east. Early explorers in the Pacific noted the marked cultural affinity between the Polynesians, Melanesians and Micronesians. In 1784 Captain Cook wrote:

From what continent they originally emigrated, and by what steps they have spread through so vast a space, those who are curious in disquisitions of this nature, may perhaps not find it very difficult to conjecture. It has been already observed, that they bear strong marks of affinity to some of the Indian tribes, that inhabit the Ladrone and Caroline Islands; and the same affinity may again be traced amongst the Battas and the Malays. When these events happened, is not so easy to ascertain; it was probably not very lately, as they are extremely populous and have no tradition of their own origin, but what is perfectly fabulous; whilst, on the other hand, the unadulterated state of

their general language, and the simplicity which still prevails in their customs and manners, seem to indicate, that it could not have been at any very distant period (Howard 1967:46).

In a theoretical extrapolation of material from Polynesian oral traditions Fornander (1878) proposed, on the basis of the tradition of naming new homelands after the names of older homelands, that it was possible to trace Polynesian migrations from Persia to Hawai'i. In a similar treatment of genealogical material Smith (1910) composed a comprehensive timetable of migration from India to Java by 65AD, from there to New Guinea, Melanesia, Fiji, Samoa and Tonga by about 450AD, and from there onward into Eastern Polynesia and its extremities between 650AD to 1350AD. Likewise Gudgeon (1902) purported to be able to trace Polynesian origins back to Egypt, and Tregear (1904) to 'branches of the Indo-European family now occupying North-Western Europe' (Howard 1967:50-52, 55-57, 59).

Other theorists utilised the then popular nineteenth century theories of race derived from Social Darwinism. Fraser (1895) suggested that Oceania had been populated by an early 'pure black race', who were later followed by a 'mixed black race'. Both were said to have originated in India and were the ancestors of 'brown Polynesians' who had, in turn, been followed by 'Mongolians' who conquered a race of 'Caucasians' living in Indonesia. Friedericici (1914) argued a mix of 'Negrito, Papuan and Malayo-Polynesian or Austronesian' racial types. Sullivan (1924) suggested Polynesians were a mix of 'Negroid/Melanesians, Mongoloids and two Caucasoid' races. Dixon (1929) added Australian aborigines in a five fold mix while Heine-Geldern (1932) argued a multiplicity of influences including Japanese, Mongoloid, New Guinean, Melanesian, Taiwanese, Philippino, Korean and Indian (Bellwood 1978:305; Howard 1967:57-59, 63-69, 83-84).

A third group stimulated by early twentieth century developments in crude archaeology promoted new ideas on old themes. Brown (1907) suggested Caucasian origins stating that:

megalithic monuments mark their path right from the Mediterranean to the Pacific, and across that ocean by Micronesia and Polynesia into Central and South America. Only in New Zealand and British Columbia did the huge timber of the forests substitute wood for stone (cited in Howard 1967:61).

Some of those who favoured a western origin argued about the route taken by the early settlers of Polynesia suggesting either a path through Melanesia or alternatively one through Micronesia. Hale (1846) hypothesised that the Polynesians had migrated from Melanesia and Papua New Guinea through Fiji, and that Fiji had then become a staging area for subsequent movement through Tonga and Samoa onward into the Society Islands from which the rest of Eastern Polynesia was settled. Later Hiroa (1938) resurrected the idea of an Indian origin while favouring Micronesia as the migratory route. Burrows (1938) suggested that two migrations had occurred into Polynesia; one into Central Marginal Polynesia from Micronesia and another into Western Polynesia via Fiji and Melanesia. Ellis (1830) supported the idea of an Indian and Malayan connection but held that an earlier population had once crossed the Bering Strait, descended through the Americas and then ventured back out into the Pacific (Hiroa 1945:12-13; Howard 1967:47, 50-51, 73-75).

In 1947 Thor Heyerdahl and five companions built the balsa-wood raft 'Kon-Tiki' in which they drifted from the coast of Peru to Raroria in French Polynesia in an attempt to prove that Peruvian Indians in pre-Inca times could have settled Polynesia in a similar manner. Later he contended that 'Kwakiutl' Indians had been forced from the northwest coast of America by 'Salish Bella Coola' Indians and that they had drifted south ultimately reaching the Hawai'ian islands. Heyerdahl also believed that a separate group of Caucasians with light skins and red hair had departed from Peru and landed in Easter Island. According to Heyerdahl these Indians found a short dark, probably Melanesian, race called 'Menehune' already living in the Pacific. A subsequent mixing of the three groups created the Polynesian race. He stated that Easter Island had been settled by 'long

ears' from Peru in about 400AD and much later by a race of 'short ears' from Indonesia. In due course the 'short ears' massacred the descendants of the long ears. He also argued that the greater distance of settlement from the Americas in relation to that from Southeast Asia was negated by the strength of the easterly prevailing winds and currents. For Heyerdahl sailing time, rather than distance, was the more significant factor (Heyerdahl 1952:177-178, 182-187, 219-345; Bellwood 1978:309-310).

Heyerdahl's ideas are supported by the Church of the Latter Day Saints; whose book The Book of Mormon, holds that the American Indians were the descendants of Hebrew settlers from Jerusalem. A descendant of these settlers named Hagoth or Hawai'iloa left the north west coast of South America in 58AD and settled in Hawai'i from which place was settled the rest of Polynesia (Howard 1967:80-82).

Lang (1877) proposed instead that the Polynesians themselves had reached Chile and subsequently populated both American continents. Dixon (1932, 1934) and Minaert (1931) argued that the Polynesians had made successful return voyages from the Americas. Adam (1955) added that the Peruvians in turn may have sailed into the Pacific although their impact on the already established Polynesians was likely to have been minimal. Some form of limited contact would in Adam's view be sufficient to explain the presence of the sweet potato in the Pacific (Howard 1967:55, 70-71, 82).

To complicate matters further there were others who proposed quite different theories of origin. Samuel Marsden (1932), an early missionary in New Zealand and Australia, suggested on the basis of biblical readings, that the Polynesians were the descendants of 'dispersed Jews'. Moerenhout (1937, 1942) noted the strength of the prevailing easterly trade winds and the non-existence of the pig and fowl in the Americas. He argued an autochthonous origin from an oceanic continent that had since disappeared. Lesson (1880, 1884) asserted that the Polynesians

had originated in New Zealand (Howard 1967:46-47, 48-54; Sorrenson 1979:14-15).

In regard to the pre-1950 theories Bellwood wrote:

...no real progress was made into the question of Polynesian origins until archaeology made its belated appearance in the 1950s. Before this over 100 years of wrangling with spurious traditions and a random smatter of ethnography had led to a rate of progress which one might, perhaps pessimistically, regard as nil (1978: 304).

In the 1950s and 1960s new techniques were developed in linguistics, archaeology, physical anthropology and ethnobotany which contributed to the new consensus that the Polynesians originated from the west. The presence of the fowl, dog and pig, coconut, yam, taro, banana and arrowroot in Polynesia supports the idea of an origin in the Indo-Malayan area. Significantly the pig and fowl were not introduced to South America until post-Columbian times. This view is also supported by modern linguistics which shows the close relationship between the languages of Polynesia, Melanesia, Micronesia and other areas of Near Oceania within the wider Austronesian grouping (See Table 1). The shared characteristics of these languages is revealed through grammatical structure, vowel sounds, consonant variation, lexicostatistics and glottochronology. The presence of the kumara throughout the Pacific, and cotton on a lesser scale, suggests at least some contact with South America (Hiroa 1945: 10-11; Houghton 1980:62-63; Davidson 1984:14-15, 1987:28-29).

The Modern Archaeological Consensus

The current consensus among archaeologists is that the Polynesians originated west of Remote Oceania. During the Middle to Late Pleistocene era when sea levels were much lower, Sumatra, Java, Kalimantan (Borneo) and several other now smaller islands comprised 'Sunda' a subcontinental extension of Southeast Asia (See Fig.2). Humanoid remains in this area indicate occupation by homo erectus between 500,000BP and 900,000BP and possibly

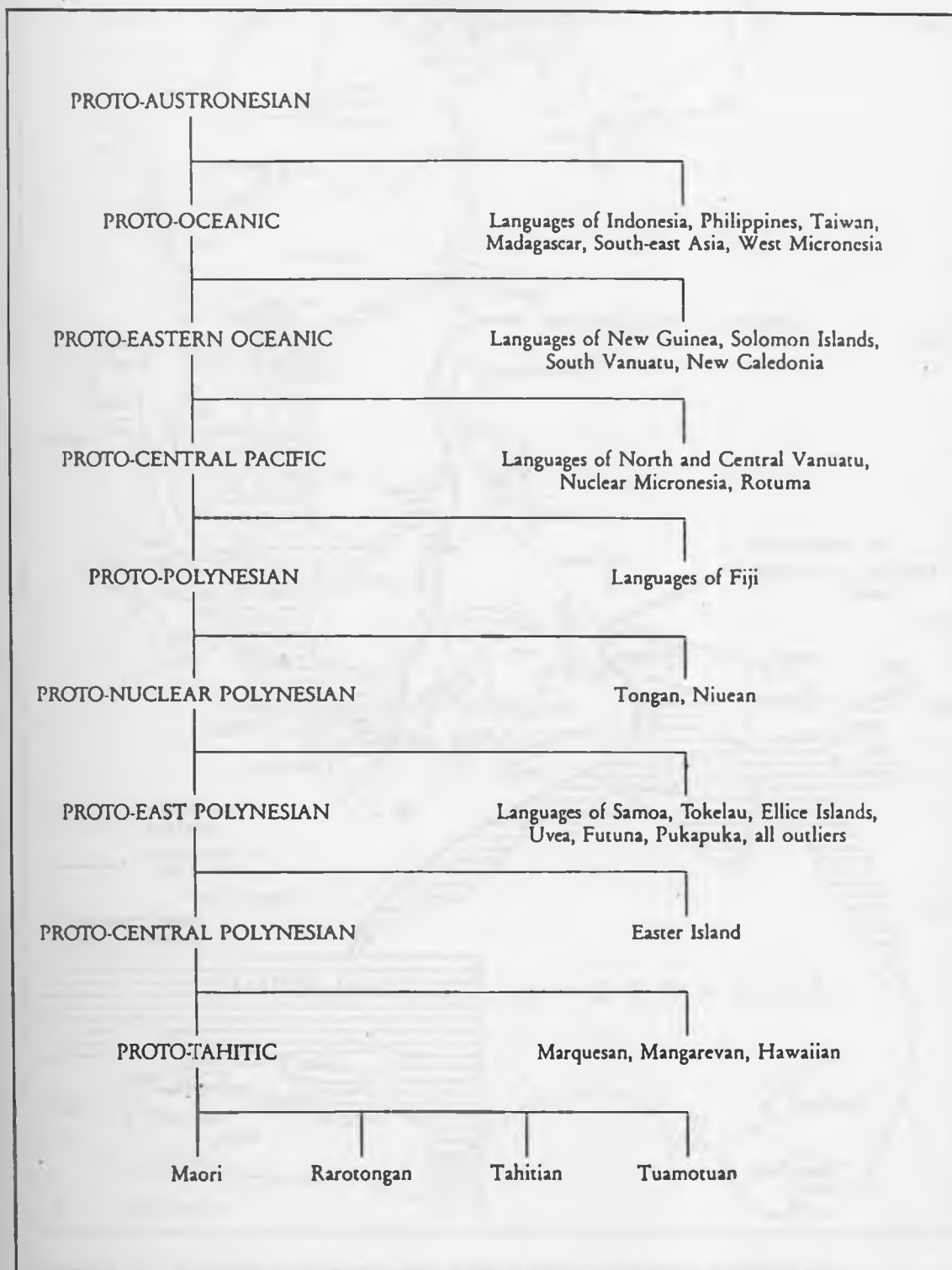


Table I: The Austronesian Language Group (Wilson 1987:28).

earlier at 1,000,000BP to 3,000,000BP. Modern human remains date from between 45,000BP to 50,000BP (Bellwood 1978:38-39, 1985:338-52; Green 1994:19-20).

The first phase of human settlement beyond Sunda involved movement into Ancient Near Oceania, between the Huxley Line and Remote Oceania. Included in this region were the then expanded islands of the Philippines, Wallacea, the continent of Sahul (Tasmania, Australia and New Guinea then joined together), the Bismark Archipelago, Greater Bukida and the sometimes enlarged islands of the Solomons (Green 1994:23, 26).

Several sites containing modern human remains in Ancient Near Oceania date from about 20,000BP. Sites in Palawan, New Guinea, Australia, the Huon Peninsula, and Wallacea date between 30,000BP and 40,000BP while more recent evidence from Arnhem Land, Northern Australia, suggests an occupation date of up to 50,000BP. Although similarities exist between the early Australian remains and those from more northerly regions of the Bismarck Archipelago and New Guinea, clear differences suggest that those in the north may have been part of a separate early migration or migrations (Bellwood 1985:173-185; Green 1994:26-27; Irwin 1992:5, 19).

From 45,000BP to 35,000BP a series of cultural, technological, ecological and biological changes took place, which in combination contributed to the further colonisation of the Pacific basin. The most important of these changes was the technological development of ocean-going craft:

The story of human expansion into the Pacific basin differs from that for Japan and the America's, however, in that it is intimately tied to the advances in the technology and management of water transport. As a consequence, it is an important chapter in world prehistory that only in the last three decades has begun to unfold, at least in outline, from the efforts of sustained archaeological inquiry...

The problem of movement of such population into the Pacific was dependent on neither the degree of their biological development nor the state of their stone

tool technology. Rather, the essential achievement was a significant advance in the cultural ability of human breeding populations to cross long stretches of open sea (Green 1994:19, 21-22).

At this time a relatively easy 'voyaging corridor' stretched from mainland Southeast Asia to the end of the Solomon Islands. Seasonal and often sheltered conditions favoured the early movement of simple craft; this also being influenced by the distance and size of island targets, patterns of inter-visibility, and highly favourable winds and currents (Irwin 1992:5-6, 19-25; Green 1994:22). Beyond the Solomons however, the islands were much further apart and usually smaller. These factors impeded further expansion and settlement for 25,000 years, or for as long as it took people to learn how to venture offshore and survive (Irwin 1992:5-6, 25, 31). The greater distance between the islands of Remote Oceania beyond the Solomons is reflected in the decreasing variety and distribution of plant and animal life. A similar difference is observable when moving eastward from Fiji and Tonga into the further reaches of the Pacific. This is the basis for the distinction drawn between Near and Remote Oceania (Bellwood 1978:136-151; Green 1994:23, 25-26).³

When sea levels began rising at the end of the Pleistocene epoch, Sunda was transformed into a greater multiplicity of unjoined islands and Australia became separated from New Guinea. The region also became culturally heterogenous with a distinct separateness emerging between the cultures of Australia and Island Southeast Asia (Wallacea, the Philippines, Java and Sulawesi, Borneo and Indonesia). The distinctive Southeast Asian Neolithic Culture, distinguishable after 6,000BP, included the appearance of new assemblages in pottery making, polished stone, and an economy based on agriculture as early as 4,500BP to 4,100BP. It was also characterised by the use of other materials in tool making such as bark-cloth, shell and stone to make fish hooks, hoes, reaping knives and other items (Green 1994:27-30).

³ The exceptions to this distribution are Australia and New Zealand (Green 1994:23).

As Australia and Island Southeast Asia became culturally separate a similar process of internal diffusion and differentiation occurred within Near Oceania (See Fig.3). The Highlands of New Guinea yield limited evidence of agricultural development as early as 9,000BP with more certain evidence dating from 6,000BP to 5,500BP. The presence of the pig at this time is reasonably well supported. Distinctive adzes date from the same period. Pottery appears later as does evidence for trade in stone. Trade in shell items dates from 10,000BP. In the lowlands of New Guinea an assemblage is found which includes several elements also found in the later sequence now termed 'Lapita Culture'. Evidence for arboriculture dates from 5,800BP and before, and, obsidian flakes, shell adzes, armbands, and pig and dog bones a 1,000 years later. Incised and lip-notched pottery may date earlier. Further out in the Bismark Archipelago, New Britain and New Ireland, evidence indicates that trade in obsidian occurred from around 20,000BP. Shell adzes and fish hooks date from 7,000BP, plain pottery from 3,850BP and oven stones at 6,200BP (Green 1994:30-31). At this time the area had also become largely Austronesian or Malayo-Polynesian speaking, these populations probably entering the area within the last 5,000 to 6,000 years. Although Southern Chinese, Taiwanese and Jomon (Japan) influences are suggested, more precise origins are still the subject of much conjecture and debate (Bellwood 1985:89-101, 119-25; Irwin 1992:37; Green 1994:37-39).

Between 3,600BP to 2,000BP sites appear in Near Oceania and the Bismark Archipelago containing the highly decorated pottery associated with the emergence of Lapita Culture. These Western Lapita sites range in size from small rock shelters and caves to small villages of 600 to 4,800 square yards to larger sites ranging from 10,800 to 86,500 square yards. Those found in the later Eastern Lapita style of Fiji, Tonga, and Samoa average 3,900 square yards (See Fig.4)(Bellwood 1978:244-264; Davidson 1984:18-20; Green 1994:31-34).

Green describes the evolution and development of Lapita in terms

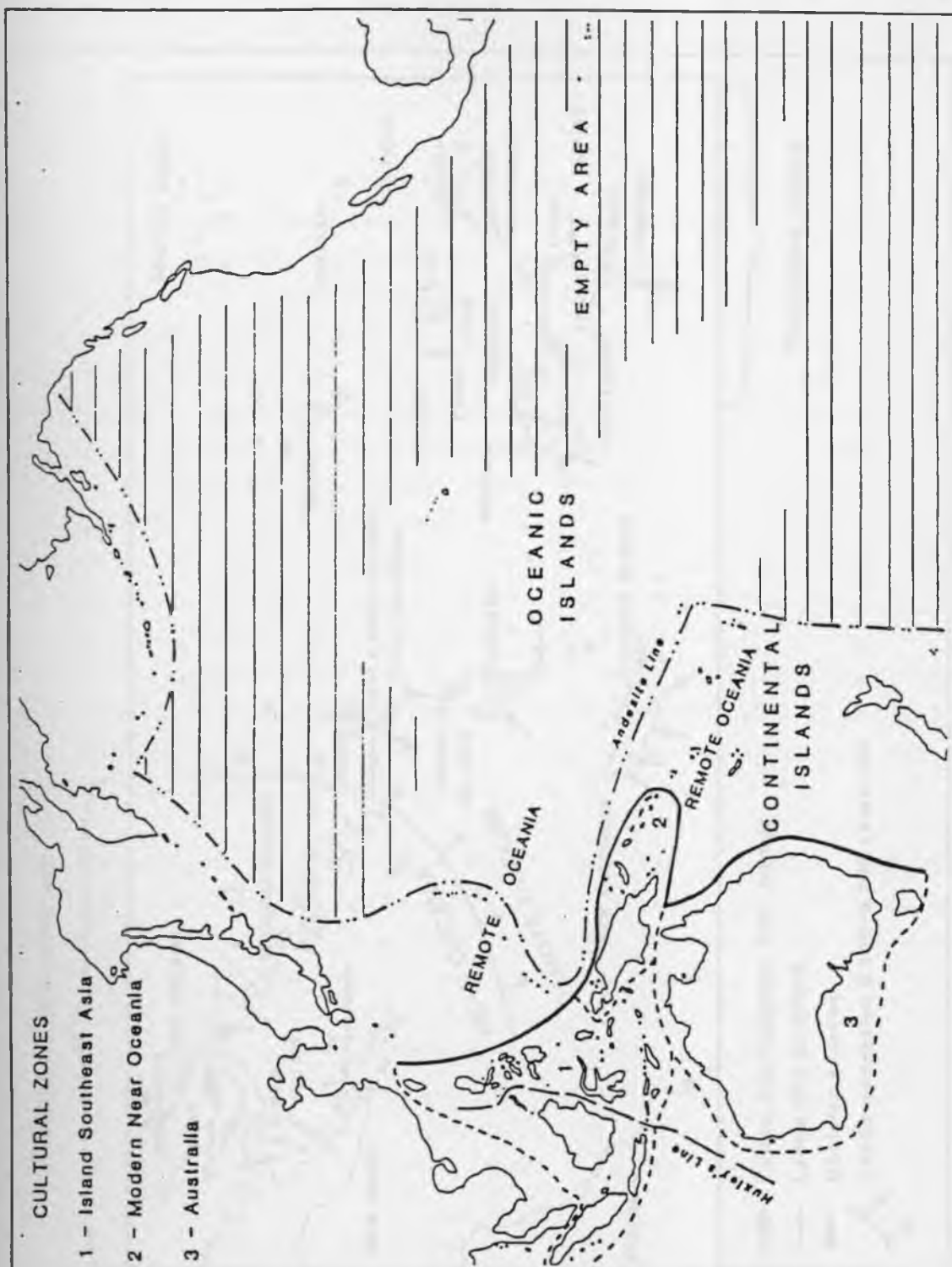


Figure 3: Biogeographic and Cultural Divisions 6000BP (Green 1994:29).

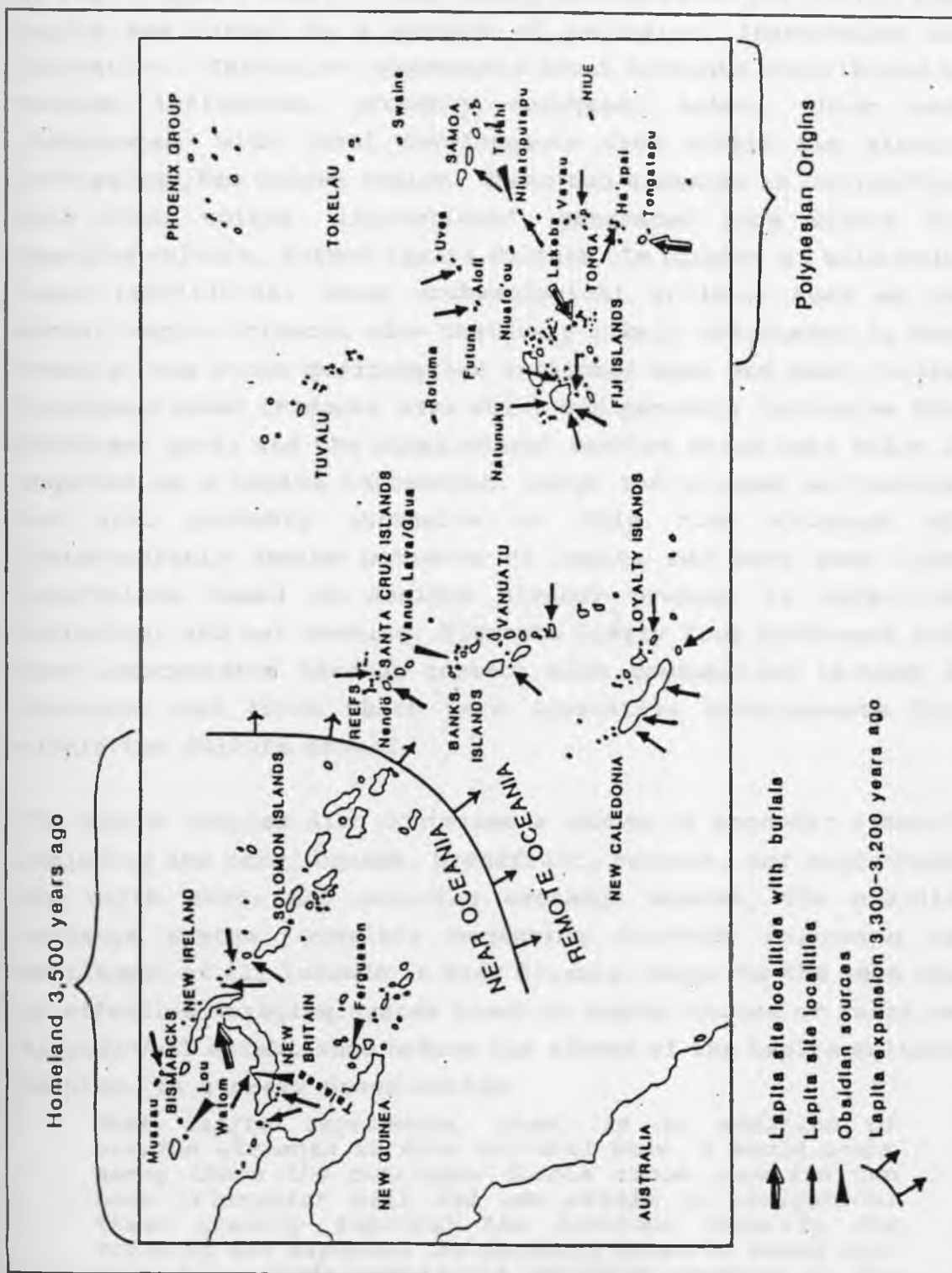


Figure 4: Lapita Sites and Expansion (Green 1994:32).

of the 'Triple I Model'. This theory incorporates the notion that Lapita was formed by a process of intrusion, integration and innovation. 'Intrusion' represents those elements contributed by outside influences, probably Southeast Asian, which were 'integrated' with local developments from within the Bismark Archipelago/New Guinea region. These two elements in conjunction with other unique 'innovations', generated from within the emerging culture, formed Lapita Culture. In support of this model Green (1994:35-36) notes archaeological evidence such as the dorsal region tridacna adze that very likely originated in Near Oceania; the stone quadrangular sectioned adze and heavy bodied hinge-portioned tridacna adze which was probably intrusive from Southeast Asia; and the planilateral section stone adze which is regarded as a Lapita innovation. Large red-slipped earthenware was also probably intrusive at this time although the characteristic design patterns of Lapita may have been local innovations based on designs already present in barkcloth, tattooing, and mat weaving. Elements likely from Southeast Asia were incorporated through contact with communities already in existence and those which were innovative developments from within the culture itself.

The Lapita complex also contained a number of economic elements including the taro, banana, breadfruit, coconut, and sugar-cane, the earth oven, and obsidian exchange system. The obsidian exchange system, possibly beginning 20,000BP following the settlement of all islands in Near Oceania, supports the idea that an effective voyaging system based on dugout canoes or rafts was already well established before the advent of the Lapita cultural complex. In summary Green writes:

What Lapita represents, then, is an addition of outside elements to this cultural base. I would count among these the outrigger double canoe plus the two boom triangular sail and new skills in navigation. These greatly improved the previous capacity for voyaging and expanded the exchange networks based upon them to include additional obsidian sources in the Admiralty islands, pottery and a wider range of other items. Other probable Lapita additions were Asian crops such as yam and banana, and new types of housing in large, permanently occupied settlements (1994:36).

The Lapita people migrated eastward at moderate pace within the Bismark region, then spread more quickly eastward into the Solomons reaching New Caledonia and Vanuatu somewhere between 2000BC and 1000BC. Sites were then established in the Reef/Santa Cruz group of Remote Oceania around the same time. This was a first move by people possessed with a common language (Eastern Oceanic Austronesian), biology (parental pre-Polynesian) and culture. Lapita society included frequent premeditated trade and communication between communities over distances up to 180 miles until movement into Solomons where distances reach 350 miles in either direction. This included an extension of already far-reaching trade networks. Finds of obsidian, metamorphosed sandstone, and muscovite/garnet/schist in the Reef/Santa Cruz group indicate communication and exchange, directly or indirectly, with communities 1,200 miles to the west in New Britain and the Admiralties. The economy contained maritime, arboricultural and horticultural components. The Lapita were effective colonisers and skilful voyagers, whose population growth was rapid and who expanded into Polynesia. About this time other groups, probably with some element of contact in their histories, sailed out from somewhere to the west of New Guinea, in the Philippines or eastern Indonesia, into the high islands of Western Micronesia. The Mariana Islands and possibly the closer islands of Belau and Yap were settled about 1000BC. The eastern atoll groups of Micronesia were settled by OAD, or possibly earlier, from somewhere between Melanesia and West Polynesia (Bellwood 1978:244-249; Green 1994:35-36, 39-40). The colonisation of Remote Oceania involved using various upwind search and relatively safe downwind return-voyaging strategies and lasted 'no more than a century or two' (Irwin 1992:6-7).

The Settlement of West Polynesia

Eventually voyagers set out from the east and west of New Guinea and by 1300BC there were Lapita settlements in Tonga. By 1000BC they had also settled Samoa. Lapita Culture itself penetrated no

further into Polynesia than this. Based on sites characterised by their trademark pottery they had spread very quickly throughout Fiji, Tonga, Samoa, Futuna and Uvea. The archaeological records of Fiji, Tonga and Samoa indicate there was extensive contact among these archipelagos (Bellwood 1978:252-253; Finney et al 1991:292; Irwin 1992:33, 39; Walker 1994).

Polynesian uniqueness in language, biological make-up and culture was not conveyed into Polynesia by Lapita already fully formed, but rather evolved within Western Polynesia. In the course of 1,000 years of progressive internal evolution and differentiation the basic elements of an Ancestral Polynesian Society were established in the first few centuries BC in Tonga, Samoa, Futuna and Uvea (Green 1994:41):

...it is now possible to view the much more homogenous populations of Polynesia as a basic population whose origins lie within the geographic area of Island Melanesia, and especially with ancestors of those biological populations there who are speakers of Oceanic Austronesian languages.

The Polynesians, however, constitute an isolate moving into a previously unoccupied part of the Pacific, and so were little affected by some 3,500 years of subsequent inter-breeding with unrelated populations [as were the Melanesians who descend from those left behind], but much affected by the small size of founder populations and genetic drift plus selection, either environmental or cultural. Thus on the basis of their teeth, anthropometrics, the white cell HLA complex and various haemoglobin and mitochondrial DNA genetic markers, an ultimate origin in Island Southeast Asia seems quite probable (Green 1994:37-38).

In part the development of Ancestral Polynesian Society can be traced to the crossing of the Andesite line which involved movement from larger continental islands to the volcanic high islands, raised coral and true atolls of the geologically Oceanic part of the Pacific in which most of Polynesia lies. This also meant a shift into an environment with a much more restricted range of rock types, soils, freshwater resources and ecological niches:

The changes are apparent, for example, in the Eastern Lapita adze kit, where forms such as the oval and planilateral stone adzes and those made on the hinge portion of the tridacna shell are lost, while others such as the plano-convex and rectangular sectioned adzes provide for continuity within the sequence, and new innovations add varieties of triangular sectioned adzes.

At this time some of the more elaborate pottery vessels are lost about half way through the Eastern Lapita sequence. Continuity was maintained through bowl forms although over time the material they are made from changed from pottery to wood (Green 1994:41-42).

Eastern Lapita evolved into Ancestral Polynesian.

The Settlement of East Polynesia

After a pause of about 1,300 years much of the rest of Polynesia was settled between 300AD to 700AD. The Marquesas were occupied directly from Western Polynesia by 300AD and became the next primary dispersal centre for the settlement of the Society Islands by 700AD, Hawai'i by 400AD to 600AD and Easter Island between 300AD to 600AD. Finally between 800AD to 1100AD the first settlements appear in New Zealand and the Cook Islands, with the Chathams being the last to be settled probably around 1000AD. Secondary colonisations of Hawai'i and New Zealand from the Society Islands are suggested (Bellwood 1978:321-326; Davidson 1984:22-23; Irwin 1992:75; Sutton 1994:3). In respect of another issue, some settlement probably also reached South America (Irwin 1992:6).

This sequence of dates represents the 'orthodox scenario' for the settlement of Eastern Polynesia (See Fig.5)(Sutton 1994:3). However one re-examination of radio-carbon dates by Kirch (1986:36) suggests that the colonisation of the Marquesas may have taken place 500 years earlier at about 200BC and furthermore, that sites in Hawai'i may predate those in the Marquesas (See Fig.6). Other prehistorians including Irwin (1992:6, 77) hold the view that earlier sites, between 3,000 and

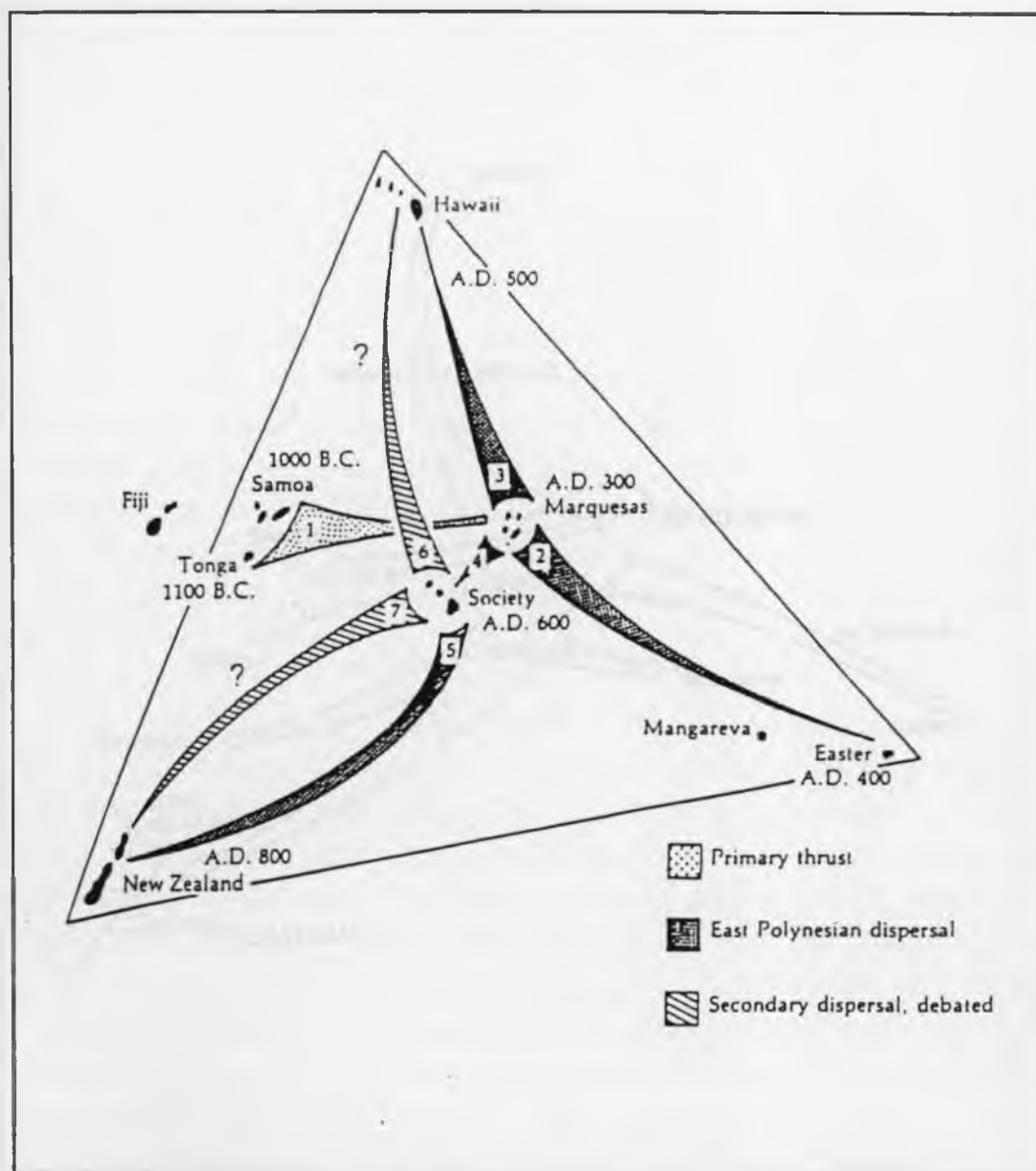


Figure 5: Orthodox Dispersal Scenario (Sutton 1994:5).

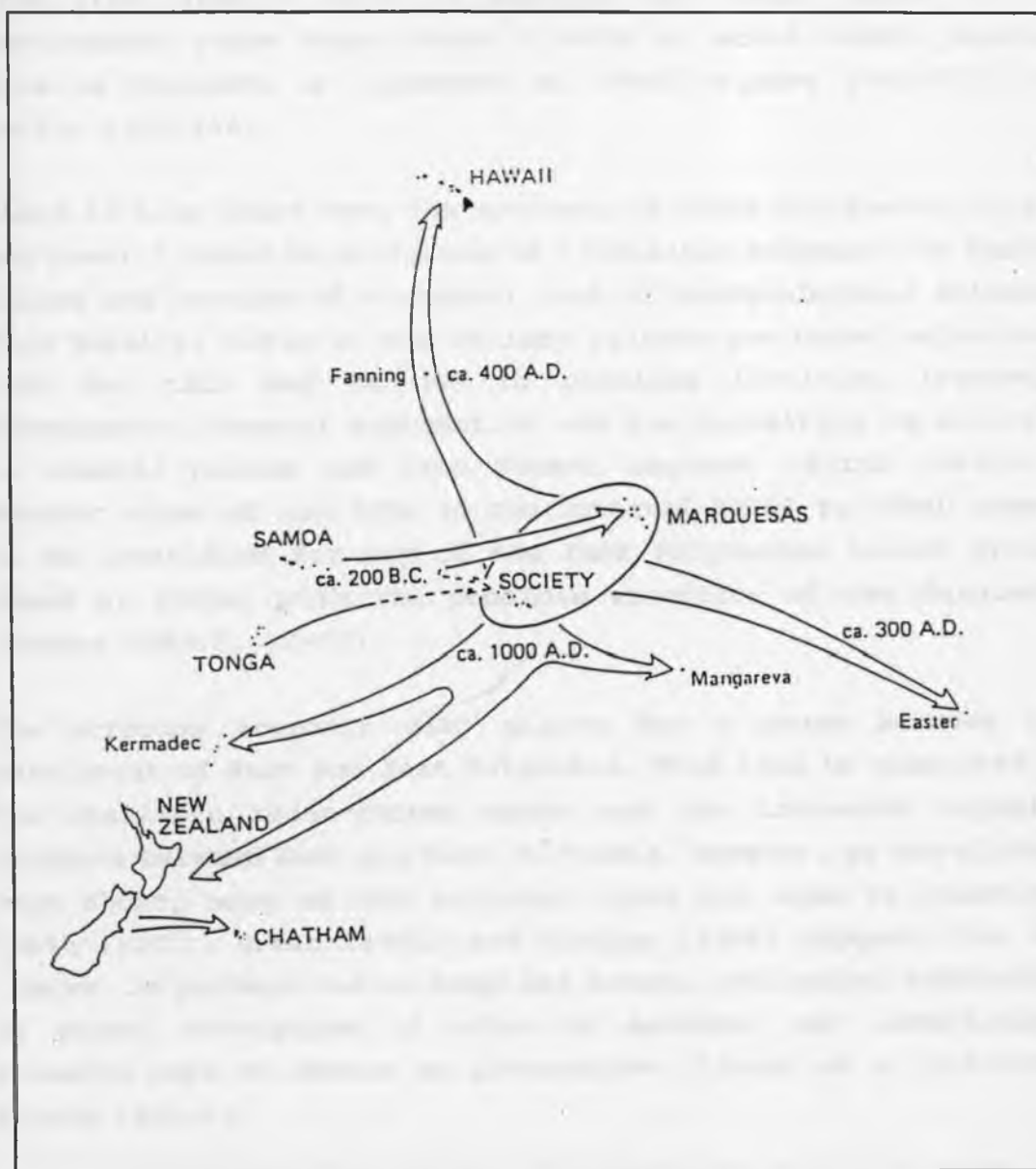


Figure 6: Alternative Dispersal Scenario (Sutton 1994:5).

2,000 years old, are still to be found among the island groups closer to Western Polynesia, such as the Cooks, Societies, Tuamotus, Marquesas, and Australs (i.e. back to 1000BC). Kirch (1993) suggests, on the basis of geochemical and pollen samples from stratigraphic cores in Mangaia that human impact on the environment there began about 2,500BP or about 600BC. Another site on Pukapuka is suggested at 300BC (Finney 1991:VIII:20; Sutton 1994:244).

There is also doubt over the accuracy of dates for Easter Island and Hawai'i based on criticism of linguistic evidence for Easter Island and because of a general lack of archaeological evidence from Hawai'i. Sites in the Society Islands are dated relatively late but this may be due to problems involving 'tectonic submergence, coastal aggradation and the deposition of alluvium on coastal plains and into former lagoons' (Kirch 1986:30). However sites of any type in the interval 300BC to 200AD remain to be identified for any of the East Polynesian island groups named by Irwin, with the possible exception of the Marquesas (Sutton 1994:5, 12-13).

The orthodox scenario also allows for a pause between the settlement of West and East Polynesia. This idea is supported by the available radio-carbon dates and the increased voyaging distance between West and East Polynesia. However, as has already been shown, many of the orthodox dates are open to question. Irwin (1981), Green (1981) and Spriggs (1984) suggest that the 'pause' is perhaps due to sampling errors, geological subducting of sites, corruption of sites by erosion, and insufficient research data to detect an alternative (Finney et al 1991:292; Sutton 1994:6).

Unless accidental voyages took place to reach distant Eastern Polynesia (Hawai'i, New Zealand, Easter Island) the passage required great feats of voyaging from the Central Polynesian groups of the Tuamotu, Society, Austral and Cook Islands. Generally speaking single voyages of discovery are assumed rather

than multiple voyages, unless new strong evidence can suggest otherwise.

Historical evidence tends to support ongoing contact between islands and island groups throughout Oceania in the form of trading networks, raiding and social exchanges. Multiple settlement of various islands is therefore also probable. Law (1994:79-81, 91, 94) argues that the Polynesians were wide ranging navigators. He notes the lack of some East Polynesian lexical innovations in the dialect of Easter Island and suggests that the kumara was brought from South America into Polynesia before the settlement of Easter Island, New Zealand and Hawai'i. He adds that voyagers would more likely have travelled in a direction from which they knew they could return and that the degree of difficulty of certain voyages contradicts what is the generally accepted pattern of settlement. For example the degree of difficulty for sailing from Rarotonga to New Zealand, or from Tahiti to New Zealand, is lower than for Mangareva to Easter Island, the Marquesas to Easter Island or from either the Marquesas and Tahiti to Hawai'i.

Intermediate Central Eastern Polynesian archaeological sequences tend to indicate that a broad sphere of regional interaction existed which was underpinned by long-distance voyaging involving trade and exchange, not unlike that which earlier had characterised Lapita and its successors in West Polynesia. One recent review of the assemblage previously referred to as 'Archaic East Polynesian' or 'Early Eastern Polynesian' is that it is likely not an early stage in Eastern Polynesia but rather an intermediate stage dating from 1000AD to 1200AD. Some of the elements usually included in this congregate such as shaped whale teeth and harpoons do not appear until much later in the archaeological record. Generally the features of this assemblage appear throughout Eastern Polynesia including New Zealand and excluding Easter Island and Hawai'i. The implication is that these places were settled before these innovations evolved (Irwin 1992:75; Green 1994: 42-43).

Material evidence of inter-island voyaging are imports consisting of the few pieces of pottery found in the Cooks and Marquesas, some pearl shell (especially that used for fishing gear) found particularly in the Cooks, and stone resources (especially those used for adzes). This continuing interaction allowed new innovations such as shaped whale tooth pendants, harpoon points, and reel ornaments, to be transferred throughout the central region, but not to Hawai'i or Easter Island (Green 1994:43). In the Cook Islands several sites dating between 800AD to 1400AD, in support of their oral traditions, indicate that voyaging within these islands occurred on a regular basis. Additionally two sherds of pottery may be from Tonga and another possibly Melanesian in origin. Other finds are linked with French Polynesia, the Northern Cooks and Australs (Irwin 1992:76; Walter 1994:222-226).

An important concept within these arguments is the idea of 'homeland' regions. Homelands are island groups spread over large areas within which shared cultural developments took place and within which continued regular contact was maintained. This had implications in other regions through processes of cultural interchange and colonisation. Rather than settlement having taken place from one island to another the concept of 'homeland regions' suggests that settlement and contact took place between groups of islands (Sutton 1994:5, 12-13). Walter (1994:228) supports the view of a high level of interisland voyaging within Central Eastern Polynesia before 1000AD:

Eastern Polynesia was a relatively homogenous culture area when New Zealand was first settled; it was only after population levels increased in relation to arable land, and voyaging frequency declined - some time after the 14th century AD - that local cultural and linguistic divergence started to occur.

Other evidence suggestive of widespread voyaging is that geographically the homeland origin of settlement for New Zealand, Easter Island and Hawai'i lies commonly within Central Eastern Polynesia, including the Marquesas, Society Islands, Southern Cooks, Mangareva, the Australs and Pitcairn (Sutton 1994:251).

South to Aotearoa

In May 1988 the New Zealand Archaeological Association held a symposium to address the following issues:

When did people first arrive in New Zealand? Where did they come from? Was there multiple or single colonisation of New Zealand? And was there return pre-European migration from New Zealand to tropical Polynesia (Sutton 1994:9).

Agreement on three of the four issues addressed was reached. The most contentious was when people first arrived in New Zealand (Sutton 1994:13). Eighty-three per cent of those who attended thought settlement occurred after 700AD while seventeen per cent thought it occurred before 700AD with most of those estimating between 500AD to 700 AD. There was a clear split between those who affirmed post-700AD dates, some believing 800AD and others around 1000AD (Sutton 1994:244).

Another 'pause' seems to appear before the settlement of New Zealand was accomplished from East Polynesia. Material innovations present in New Zealand provide strong evidence that it was settled from Central Eastern Polynesia well after 800AD (Davidson 1984:61-114). Anderson (1989:171-176, 1991:768) who examined dates 600BP or greater (charcoal, moa bone collagen, and marine shell samples) concluded that the evidence for very early settlement was insufficient.

Recently another review of the radio carbon dates by McClone, Anderson, Holdaway (1994:144-145) has identified several problems associated with the number of available dates and the quality of dated material. The most reliable are those dated around 600 to 700 years ago. These sites indicate that by 1200AD settlers were conversant with all the major resources of New Zealand, for example, finds of obsidian from Mayor Island are present in many sites all over the country. This suggests that some years must have elapsed before such a comprehensive knowledge of the resources available could have been gained. They concluded it was

likely that settlement occurred within the last 1,000 years.

Many archaeologists express the view that the date of colonisation could better be established by dating first human impact on the vegetation, as identified in pollen cores. On the basis of this type of controversial evidence Sutton (1994:8-92 45-246) suggests that New Zealand may well have been first settled 1,750 years ago, between 0AD and 500AD, or earlier. He notes that recent voyages, such as those by the *Hokule'a*, *Te Aurere* and *Hawaikinui*, have shown the ease with which voyages from Rarotonga to New Zealand can be made. Furthermore, Finney's (1994:52-73) and Grant's (1994:164-191) depiction of weather patterns suggests that a vessel latitudinally sailing east to west could have been drawn south on the margin of an anticyclone. This raises the possibility of discovery before much of the rest of East Polynesia was settled (Sutton 1994:246; Green 1994:41).

Sutton (1994:246-250) also argues that the error in early dates may not be so great, and that a shortage of dates from the North Island may be especially significant since this is considered a likely area of first landfall. There is also the crucial issue concerning the presence of people and their archaeological visibility. This depends on population size, susceptibility of environment to human impact, settlement distribution and rate of increase of population. One option is to suggest that there was a large planned emigration of hundreds of people which is itself impractical because of the logistics. There is strong evidence to suggest that few people travelled on canoes. Given the difficulties of a voyage to New Zealand a large migration of multiple canoes at one time is unlikely. Additionally, the fertility rate of the Maori population was very low, and estimates of mortality high (Houghton 1980:147-149). This also suggests that a small founding population could have remained hidden for a number of years and perhaps a few hundred years.

A possible increase in the time depth of settlement in the Cook Islands also raises the possibility that New Zealand was settled

earlier than previously allowed. Another suggestion is that it would have been quite possible to have settled New Zealand at 100BC from Fiji-West Polynesia. However all present evidence suggests that even if an earlier date is established New Zealand was not likely to have been settled before the Taupo eruption of 1,800BP or 150AD (Sutton 1994:8).

The difficulties of sailing into the southern zone suggest a later settlement date. Irwin (1989:185-186, 1992:6) noted that year round the wind patterns are different, the weather cooler and sailing conditions generally more difficult. He suggests the risk of sailing to Aotearoa would explain the lateness of settlement especially while other islands in Eastern Polynesia remained unsettled. The conventional view of settlement after 800AD is therefore widely supported but not beyond challenge.

Forty years ago scholars firmly established that New Zealand had been first settled from Eastern Polynesia (Davidson 1984:25). Speculative debate continues as to which particular island group those settlers originated from (Green 1994:42). A New Zealand 'homeland' concept may extend through the Marquesas, Society, Southern Cooks, Australs, plus Mangareva and Pitcairn islands. Pitcairn stone technology including large numbers of adzes and other tools has a high degree of similarity with that found in New Zealand as do finds in two early Marquesan sites on the islands of Nuku Hiva and Ua Huka. A burial site on Maupiti Island in the Society Group bears a close resemblance to a similar site and artifacts found at Wairau Bar in Marlborough. Other archaeological material found at Vaito'otia and Hane on Huahine Island in the Society Group also has strong parallels with early sites in New Zealand. However, not enough precise archaeological evidence exists to identify a more exact source of migration to New Zealand (Davidson 1984:23; 1994:210-214). The linguistic evidence as reviewed by Biggs (1994) and Harlow (1994), in an attempt to identify specific islands of origin suggests a broad area of origin rather than any specific island or group (Sutton 1994:251).

Debate continues about whether or not the founding settlements in New Zealand were, as in the oral tradition, multiple and successive or, singular and isolated. Neither has it been established whether or not New Zealand was part of the broad sphere of regional interaction encompassing the central zone from the Marquesas and Mangareva to the Southern Cook Islands, which only began to lose its links after 1200AD when the monumental stone marae-ahu-tahua complex, stone food pounder, and new types of adzes appeared in Central East Polynesia.

One argument in favour of single or limited voyaging is the pre-historic absence of the pig and chicken in New Zealand. However, their failure to survive here may have been due to a number of factors such as the cold or hardship of transfer via canoe. Alternatively, a deliberate decision may have been made not to introduce them. Cook failed in an attempt to rear tropical pigs here and introduced the modern pig population from the northern hemisphere. Additionally, the staple diet of the domesticated pig throughout the Pacific was kumara. Significantly, the early New Zealand populations had to overcome difficulties of growing it in a more temperate climate (McClone et al 1994:149).

Multiple voyaging and return voyaging are suggested by the pearl shell lure found at Tairua in New Zealand, the finding of Mayor Island obsidian in the Kermadecs, and the archaeological presence of the New Zealand Maori in Norfolk island. All these examples date to within the last 600 years and at a time when such widespread trade and exchange are attested in styles from the Southern Cook Islands. Return voyaging is also supported by the current resurgence of ocean going waka (Green 1994:43; Sutton 1994:253; Walter 1994:220-228).

Weather patterns, the length, and difficulty of sailing to New Zealand, suggest most probably that any voyaging there was deliberately expeditionary. This may also have involved the passing of information back to a source island. Two-way voyaging within a homeland region would have led to the widespread

transfer of location and information and therefore, there could have been a large number of arrivals over several decades (McClone et al 1994:147-148).

The idea of limited or single voyages to Aotearoa has some problems. For example a small founding population would have had to have brought with them an extensive knowledge base concerning:

...woodworking, weapon and stone tool technology, fishing, fowling, horticulture and food processing and preserving, and an impressive body of eastern Polynesian traditions, place names, and plant and animal names. As well they must have successfully transferred the dog and rat, and kumara, yam, taro, gourd, tropical cabbage tree, and paper mulberry (McClone et al 1994:147).

Law (1994:245) argues that statistically the probability of single settlement is low and that multiple settlement is likely.⁴

Summary

This chapter contains a detailed summary of the archaeological, historical and other evidence concerning the settlement of the Pacific basin and, more specifically, Island Polynesia.

The archaeological sequence of settlement suggests an evolution of navigating and deliberate voyaging that began as early as 40,000 years ago. A direct relationship between the speed at which that technology evolved and the settlement of Polynesia is also implied. A 25,000 year pause occurs between the completion of the initial settlement of Near Oceania and the beginning of the settlement of Western Polynesia and Remote Oceania. A further pause, although its length is contested, occurs before the settlement of Eastern Polynesia from Western Polynesia. The third occurs before the settlement of New Zealand. Each of these pauses

⁴ Orbell (1985:5) also points out that the range of mythological ideas, narratives and names in Aotearoa may have exceeded those in any one small area of Central Polynesia.

seems to be related to the distance required to be crossed and the difficulties presented by the required navigation. Each also appears to occur at times which are directly correlated with evidence for widespread trade via sea lanes, that is, when deliberately navigated voyages were taking place.

The idea of 'contact regions' or 'homelands' is another central theme in the cultural evolution of Near and Remote Oceania including West and East Polynesia. The major cultural dynamic suggested is one of contact being maintained within regions, over long periods of time and usually at some considerable distance. It would seem that the migration of peoples deeper into the Pacific occurred in conjunction with the development and evolution of these spheres of contact.

The archaeological sequence also provides a useful basis and time line against which the material in later chapters can be compared.

CHAPTER TWO

THE NAVIGATION DEBATE

The Polynesian Archipelago extends over an oceanic environment 955 parts water to five parts land. It is bound by Easter Island situated to the east, New Zealand to the south, Hawai'i to the North, Tonga, Samoa, Fiji and the Polynesian Outliers of Kapingamarangi, Bellona, Rennell, Nukuoro, Anuta and others in the far west. The discovery and settlement of Polynesia, from 1500BC to 1000AD when the Chathams were finally settled, is one of the most remarkable maritime achievements of all time. Its end marked the beginning of the Vikings' venture to Greenland and predated, by 500 years, the accomplishment of Columbus.

The oral traditions of the Polynesians imply that colonisation was usually the result of deliberate voyaging. They also speak of return voyages being made between islands and island groups over long distances. The question remains however as to whether or not the ancestors of the Polynesians were capable navigators as implied in the traditions.

Polynesian maritime exploration and settlement has been the subject of much conjecture, romance, myth-making and vilification. The famous painting by Goldie depicting the arrival of the first settlers constitutes part of the denigration of the Polynesian achievement (See Fig.7). The crew are emaciated and desperate, the sails tattered, and the canoe diminutive. In contrast the painting by Watkins portrays a more romantic and idealistic 'fleet' scene (See Fig.8). These paintings represent

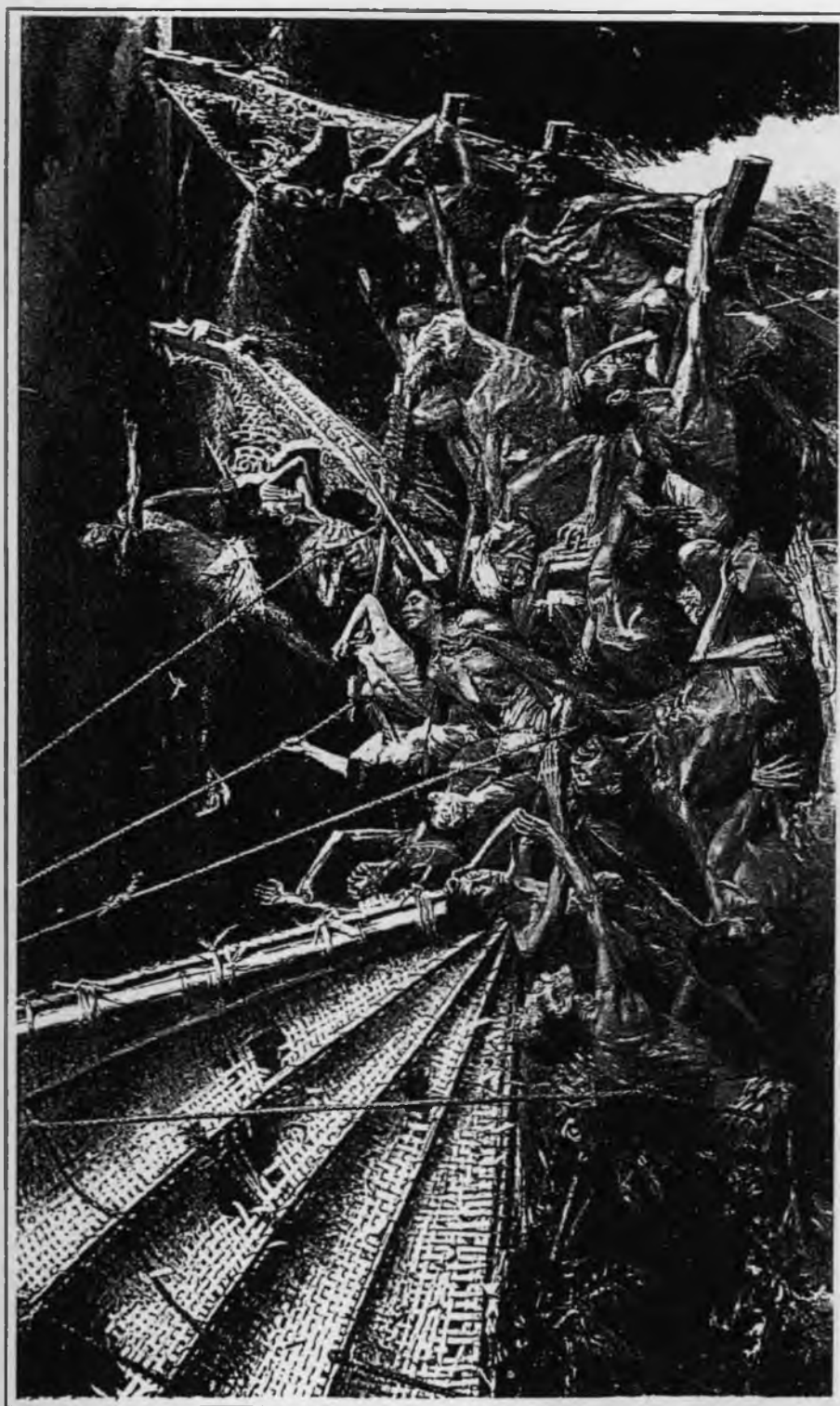


Figure 7: Portrait of Desperate Landing in New Zealand by Steele and Goldie (Sorrenson 1978:48-49).

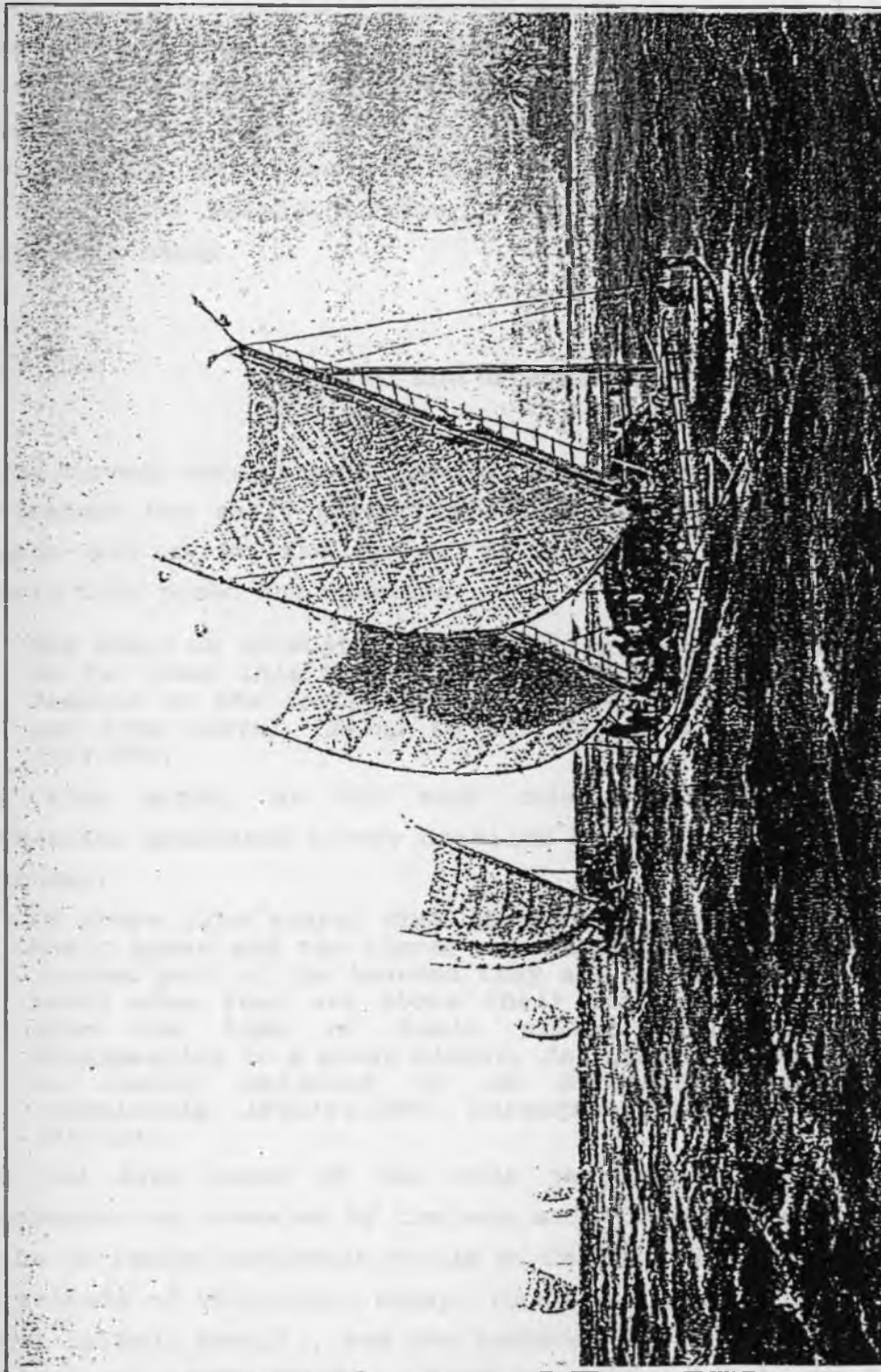


Figure 8: Romantic Depiction of 'Fleet' leaving for New Zealand (Auckland Public Library, Art Gallery).

the two contrary views held about Polynesian navigational ability since contact. One opinion suggests, rather romantically and almost without question, that Polynesians were admirably capable mariners and the other, more prejudicially, affirms that simply they couldn't have been (Walker 1990:25-26). Although both positions have received favour, for many years neither was empirically based.

Explorers and Missionaries

Having already noted the uniformity of language and culture among Polynesians the early explorers speculated as to their common origins and as to the manner of their dispersal.⁵ In 1778 Captain Cook posed the question:

How shall we account for this Nation spreading itself so far over this Vast Ocean? We find them from New Zealand to the South, to these islands to the North and from Easter Island to the Hebrides (Beaglehole 1967:279).

Cook also noted, as did many other Europeans, that the Polynesians possessed a very detailed knowledge of astronomy:

Of these [the stars] they know a very large part by their names and the clever ones among them will tell in what part of the heavens they are to be seen in any month when they are above their horizon; they know also the time of their annual appearing and disappearing to a great nicety, far greater than would be easily believed by an European astronomer (Beaglehole 1962:v1:386; Parsonson 1962:41; Irwin 1992:14).

Cook was also aware of the wide geographical knowledge of Polynesians as revealed by the map made from information given by the Ra'iatean navigator Tupaia at Tahiti which showed most of the islands of Polynesia, except those at the margins including Easter Island, Hawai'i, and New Zealand. The Tongans also told Cook of 156 or more islands in Western Polynesia (Irwin 1992:13-14; Parsonson 1962:14-15).

⁵ See Chapter 1.

Other early explorers noted that the Polynesians had an extensive knowledge of wind and weather patterns. Bougainville in 1768, acknowledged that the Polynesians were more skilled than Europeans at the short forecasting of weather up to periods of three days. In regard to the prevailing easterly trade winds in the central Pacific Cook noted in Tahiti that these were subject to seasonal variation. He also recorded from Tupaia, that westerly winds with accompanying rain became prevalent from November to January and that the Polynesians 'know very well how to take the advantage of these in their navigations' (Parsonson 1963:14-15, 41; Beaglehole 1968:137-139). In 1799 Wilson wrote:

...the men are excellent judges of the weather from the appearance of the sky and wind, and can often fortel [sic] a change some days before it takes place. When they are going to any distant island and lose sight of land they steer by the sun, moon and stars, as true as we do by compass. They have names for the fixed stars and know their time of rising and setting with considerable precision (cited in Parsonson 1962:41-42).

These few examples indicate that the Polynesians possessed, at the time of contact, the main elements of any navigation system that is, a good understanding of the stars, winds, swells and the weather. The most complete account of how these elements were combined within the Polynesian system of navigation is that left by Andia-y-Varela from a 1772 to 1776 Spanish expedition in the Pacific:

They have no mariners compass, but divide the horizon into sixteen parts, taking as the cardinal points those at which the sun rises and sets...when setting out from port the helmsman reckons with the horizon thus partitioned, counting from the East, or the point where the sun rises: he knows the direction in which his destination bears: he sees also whether he has the wind aft, or on one or other beam, or on the quarter, or is close hauled: he knows, further, whether there is a following sea, a head sea, a beam sea, or if it is on the bow or the quarter. He proceeds out of port with a knowledge of these [conditions], heads his vessel according to his calculations, and aided by the signs the sea and wind afford him does his best to keep steadily on his course. This task becomes more difficult if the day is cloudy because of having no mark to count from for dividing out the horizon. Should the night be cloudy as well, they regulate

their course by the same signs: and since the wind is apt to vary in direction more than the swell does, they have their pennants of feathers and palmetto bark, to watch its changes by and trim sail, always taking their cue for a knowledge of the course from the indications the sea affords them. When the night is a clear one, they steer by the stars; and this is the easiest navigation for them, because there being many, not only do they note by them the bearings on which the several islands with which they are to touch lie, but also the harbours in them, so that they make straight for the entrance by following the rhumb of the particular stars that rise or set over it: and they hit it off with as much precision as the most expert navigator of civilised nations could achieve.

They distinguish the planets from the fixed stars by their movements: and give to them separate names. To the stars they make use of in going from one island to another they attach the name of the island so that the one which serves for sailing from Otaheite to Oriayatea has those same names, and the same occurs with those that serve them for making the harbours in those islands.

What took me the most in two indians I carried from Oriayatea was that every evening or night they told me or prognosticated the weather we should experience the following day, as to winds, calms, rainfall, sunshine, sea and other points, about which they never turned out to be wrong: a foreknowledge worthy to be envied, for, in spite of all that our navigators and cosmographers have observed and written anent the subject, they have not mastered this accomplishment (cited in Denning 1962:112-113)

As a consequence of these sorts of observations Cook suggested that settlement of Polynesia, as a result of deliberate voyaging, had been quite possible:

In these proes or Pahee's....these people sail in those seas from Island to Island for several hundred Leagues, the sun serving them for a compass by day and the moon and Stars by night. When this comes to be prov'd we Shall be no longer at a loss to know how the Islands lying in those seas came to be people'd, for if the inhabitants of Uleitea [in the Society islands] have been at Islands laying 2 to 300 leagues to the westward of them it cannot be doubted but that the inhabitants of those western Islands may have been at others as far to the westward of them and so we may trace them from Island to Island quite to the east Indias (Parsonson 1962:15).

However, two companions of Cook, Forster and Anderson, suggested to him that the ability of Polynesians to navigate had been exaggerated and that settlement was due to accidental voyaging. Toward the end of his third trip in 1777, and upon being the first European to visit Mangaia and Atiu in the Southern Cook Islands, Cook found three Tahitians, countrymen of his interpreter Omai, who were survivors from an original canoe load of twenty-one, that had been swept some 600 miles there while on a trip from Tahiti to Ra'iatea. Cook wrote in his journal that this:

...will serve to explain, better than a thousand conjectures of speculative reasoners, how the detached parts of the earth, and, in particular, how the South Seas, may have been peopled; especially those that lie remote from any inhabited continent, or from each other (Sharp 1956:4).

Anderson, Cook's surgeon and adviser, added, in regard to Tahitian knowledge of other islands, that it must have been:

...communicated to them by the natives of those islands, driven accidentally upon their coasts, who, besides giving them their names, could easily inform them of the direction in which the places lie from whence they came and of the number of days they had been upon the sea (Parsonson 1962:16).

Many other drift voyages were recorded by other Europeans. In 1797 Wilson of the *Duff* made a very explicit case about migrations occurring under stress of weather when canoes were driven from island to island and from one group to another. Lang (1877) who sailed in the Pacific in the mid-nineteenth century emphasised accidental storm drift while also allowing some adventurous voyaging and the forced voyages of exiles. Others such as Beechy (1831), Bennett (1841), Jarves (1843) and Findlay (1884) also mentioned involuntary voyages, including some one-way voyages of exile. One such voyage had begun as a voyage from Mangareva to Fiji and ended up as a 3,700 mile voyage to Sikaiana, another from Easter Island went 3,500 miles to Atiu (Parsonson 1962:18-19, 33-35; Golson 1962:139; Irwin 1992:14-

15).⁶ In 1866 Pritchard said:

It cannot be doubted that the early migrations of the ancestors of these islands were involuntary rather than the result of roving dispositions, or of the pressure of limited and over-populated homes; that in fact, they were blown away from their earlier homes in their frail canoes (Irwin 1992:15).

Pritchard also noted an irregularity in that the pattern of recorded drift voyages ran from east to west, before the prevailing trade winds, rather than from the east to west before the westerly winds which, although they blew less frequently, blew with greater fury. He also noted that when westerlies were prevalent the Western Polynesians tended not to venture out except when deliberately utilising those winds for voyages from Fiji to Tonga (Parsonson 1962:20).

The drift-involuntary voyage line was more often promoted by missionaries to which Denning makes the following point:

They reacted strongly in their descriptions to the romanticism of the explorers, and they tended to belittle Polynesian achievements, the better to point the contrast between pagan degradation and the Christian contribution (1962:113).

Others differed with their colleagues. John Williams (1837), head of the London Missionary Society mission at Ra'iatea in the Society islands from 1817 to 1839, wrote in regard to the west to east colonisation, the prevailing easterly trade winds, and the great distance from Southeast Asia to Eastern Polynesia that although:

...it is thought to have been impossible for the natives to perform such a voyage with their vessels and imperfect knowledge of navigation...that if we can show that such a journey can be performed by very short stages, the difficulty will disappear (cited in Irwin 1992:15).

He also noted that the trade winds were not so constant as to prevent voyagers from the west reaching the island groups in the east. In support he gave an explicit account of the westerly

⁶ See Golson (1963:138-149) for a comprehensive list.

winds that were known to the Tahitians, their names, the months they blew, their duration and patterns of change. Additionally he described various of his own voyages including one of 800 miles from Rarotonga to Tahiti with a fair wind in a latitude where easterlies were generally prevalent (Parsonson 1962:18; Irwin 1992:15).

These early years of debate suggested the likelihood of a Polynesian capability for deliberate voyaging and the further likelihood that this ability coupled with some accidental voyages may account for the settlement of Polynesia. In summary of this position Irwin wrote:

These few examples (and there are others) show that some 200 years ago it was already realised that many Pacific islanders were related and probably had an origin in the west, not the east; that the prevailing easterly winds were interrupted, especially in some months, and that westerly winds could be used strategically for sailing east; that Polynesian specialists had wide geographical knowledge as well as a detailed understanding of astronomy, tides, weather and other matters; that navigators could maintain their sense of direction at sea, as shown by Tupaia on his voyage with Cook; that the means of colonisation of Pacific islands could range from systematic and intentional voyaging to unintended and largely undirected accidents (1992:14-15).

The Romantic View

By the end of the nineteenth century the theory of deliberate voyaging had become widely accepted. Some like Fornander (1880), Tregear (1904), and Smith (1898, 1904, 1910, 1921) proposed grandiose easterly migration theories, which drew uncritically on Polynesian oral traditions, although not all were entirely willing to accept their view. Some like Thor Heyerdahl continued to resurrect the Americas theory of a Polynesian origin (Finney 1979:323; Sorrenson 1979:45).

Smith (1898), Best (1924), and Buck (1938) espoused the idea that Polynesian navigators had been able to venture out, explore and

discover new lands, and return home safely with sailing directions others could follow. Hiroa suggested that this process had occurred over several centuries (Irwin 1992:16). Although their ideas had become widely accepted they were no more than assumptions awaiting empirical proof.

Percy Smith (1898, 1904, 1910, 1921) in Hawaiki noted the link between astronomy and navigation:

It is well known to all acquainted with Polynesians that they have a very complete knowledge of the heavens, and the movement of the stars, etc, to all the prominent ones of which they gave names. In the accounts of the coming of the six canoes to New Zealand in the 14th century we have references to the stars by which they steered (1904:137).

However he failed to provide any specifics about the practical application of the Polynesian astronomical navigation system. Even the detailed directions which he collected from the Hawai'ian traditions are imprecise and unenlightening:

If you sail for Kahiki [Tahiti] you will discern new constellations and strange stars over the deep ocean. When you arrive at the Poki-o-Wakea (equator) you will lose sight of Hokupua and then Newe will be a guiding star and the constellation of Humu will be as a guide above you (Smith cited in Denning 1962:111).

Te Rangi Hiroa, also known as Sir Peter Buck, chose a romantic title for his book Vikings of The Sunrise in which he wrote:

The term Viking has come to mean bold, intrepid, mariners and so is not the monopoly of the hardy Norsemen of the North Atlantic. To the Polynesians the sunset symbolise death and the spirit land to which they returned, but the sunrise was the symbol of life, hope, and new lands that awaited discovery (1958b:vi).

Hiroa had a good deal to say about the marine technology of the Polynesians. He described the construction and use of double hulled canoes, outriggers and sails but failed to elaborate in a more specific, pragmatic way about navigation methodology itself. He did not describe in any detail how Polynesians were able to either set course, locate land, or make landfall.

Elsdon Best, another prolific writer on the Maori, was no more illuminating. In his book The Maori As He Was he wrote:

Polynesian navigation methods are of surpassing interest.. ignorant alike of compass and charts they steered their primitive craft by the heavenly bodies, and by the regular roll of the waves before the trade winds (1924:33).

His view was a mixture of romanticism and derogation by firstly acknowledging Polynesian navigational ability then denigrating it with the pejorative use of the words 'ignorant' and 'primitive'.

Although unproven, the position asserted by Buck, Best, and Smith met with general acceptance for two generations remaining uncontested until the mid 1950s.

Accidental Voyaging

In 1956 and 1957 Andrew Sharp published Ancient Voyagers in the Pacific in which he launched a devastating attack on the 'romantics' by arguing that the Pacific had been settled by a series of 'accidental drift voyages' during the history of which 200,000 'souls' had been lost at sea (1956:163).

Sharp's theory of drift voyage rested on a number of propositions the first of which was that Polynesians could not navigate beyond a certain range because of their inability to calculate and overcome the problems of unknown set and drift; that is displacement caused by current, and deviation from course caused by winds. These problems, according to Sharp, were to the Polynesian 'undetectable within the margin of error of navigation' (1956:16).

Although he acknowledged the Polynesian capability to navigate according to the sun, moon and stars, he argued that it became severely limited under overcast conditions of cloud, mist or storm. In support of his theory he quoted James Cook who in regard to the Tongans had written:

...the sun is their guide by day and the stars at night. When these are obscured, they have recourse to

the points from which the winds and waves come upon the vessel. If during the obscuration the winds and the waves should shift... they are then bewildered, frequently miss their intended port and are never heard of more (Sharp 1956:16).

The inability to maintain course under these conditions, coupled with an absence of navigational aids for fixing position, argued Sharp, resulted in the hapless victims being driven on the mercy of the sea. He concluded, therefore, that the effective limit of their navigational ability consisted of voyages of several days between islands where the 'conditions of wind and current were convenient', and that the range of deliberate voyage and settlement was short, and furthermore, that the only possible means by which long distance settlement had occurred was that of accidental drift voyage (Sharp 1956:13-15).

Sharp divided Polynesia into three major island groups. Samoa, Tonga, Rotuma, Tuvalu and Fiji formed the western group within which the longest distances without intervening islands were between 200 to 300 miles. 1,000 miles eastward lay the Society, Cook and Tuamotu Islands, comprising the eastern archipelago, within which the longest gaps without intervening islands were between 170 to 230 miles. The third grouping Sharp distinguished were those islands that lay outside the two main groupings i.e. New Zealand, the Marquesas, Hawai'i and Easter Island. According to his thesis the settlement of Eastern Polynesia had occurred when voyagers from the westward islands, who had either been blown off course or had become lost, had crossed the gap into the eastern area (1956:1-2).

Sharp (1956:10-13) also attacked the effective applicable range of other Polynesian navigation methods. He argued that, although the Polynesians might, when the sun, moon, and stars were obscured, attempt to maintain course by observing the constant angle of the wind and wave patterns, these alternative methods were limited because of wind shifts and variations in pattern over longer periods of time and distance.

Another feature of Polynesian navigation was the use of land marks on home islands as back markers to plot courses according to astronomical coincidence with the said markers. Sharp argued that such methods allowed for the calculation of direction but did not enable the navigator to calculate speed and distance, and therefore, if the stars became obscured the navigator could easily overshoot or undershoot his destination. He further added that once this had occurred the navigator would then have to conduct a search in order to locate the target island. Sharp then argued that Polynesian double hulled canoes were incapable of sailing close to the wind while conducting a search pattern, and that unless they were very lucky they ran a high risk of becoming lost (1956:20-26).

Sharp's idea was not new and he made much reference to the observations of nineteenth century explorers, adventurers and missionaries including what he called Cook's 'forgotten theory' (1956:4).⁷ In regard to the Western area Sharp quoted many early European observers including Cook (1784), Martin (1817), Dillon (1829), Wilkes (1845), and Hale (1846) who had written that the Western Polynesians frequently sailed at length between the islands they were familiar with but not much further than between 200 to 300 miles. He included one significant reference by an early missionary to Samoa who commented on the excellence of the Samoan canoes and their ability to sail, but also noted they did venture beyond their own islands (Sharp 1956:5-6, 12). He cited similar evidence in regard to Eastern Polynesia. In 1777 William Anderson had interviewed various Tahitian and Tuamotuan voyagers and found that the furthest distance they, at that time, were voyaging was the 170 to 230 miles between Tahiti and Tuamotu. Another observer, Spaniard Andia-y-Varela, stated that the Tahitians sailed up to forty to fifty leagues within the Society and Tuamotuan islands (1956:6, 12-13).⁸

⁷ See Chapter One.

⁸ A league is approximately 3 miles (Collins Dictionary 1979:836).

In summary he wrote that, according to the accounts of early Europeans, deliberate voyaging only took place within Western Polynesia over distances up to 300 miles and within Eastern Polynesia over distances up to 230 miles, and that deliberate longer range voyaging outside of the two main groupings did not occur. Contact was between islands that were close by, with the occasional relief from isolation being provided by accidental voyages (1956:2).

In regard to Polynesian geographic knowledge, Sharp argued that the cognizance of the existence of other islands was transmitted about the Pacific by accidental voyage. He listed a long number of 'accidental voyages' of up to 600 miles recorded by early Europeans including Cook (1785), John Williams (1837), William Ellis (1831), William Wyatt Gill (1867). He made the point that such people become 'a living embodiment to their hosts of the islands whence they came, and a source of traditional knowledge of them' (1956:11-12).

In 1769 Tupaia, a Tahitian from Ra'iatea, gave a now famous list of islands to James Cook on his first trip to that island. According to Cook he drew a chart of seventy four islands and indicated several he himself had visited. John Forster a naturalist with Cook published this list, along with another, gathered by himself during Cook's second voyage, in 1778. Although Tupaia claimed to have sailed to islands in the west, one of which took ten days to reach and thirty days to return from, Cook surmised that these were the Tongan islands some 1,200 miles west of Tahiti. Sharp dismissed the claim by concluding that they were in fact islands in the far west of the Society group (1956:8).

Although Sharp minimised much of Tupaia's data he did admit that at least eight of the islands on the list lay outside Eastern Polynesia and that another four, placed incorrectly on the chart produced by Forster in 1893, were evidential of pre-European knowledge. In regard to this admission he accepted Anderson's

1777 summation that the Eastern Polynesians knew the names of islands because these were communicated to them by accidental voyagers. He also noted that Niue, some 280 miles east of Tonga, and all of the islands of Eastern Polynesia, were noticeably absent from the list of 156 islands collected from the Tongans in 1777 by Cook and Anderson. He also intimated that the east and western groups had only become well known to each other as the result of European contact (1956:2, 4, 7, 9-11).

Sharp stated, with reference to the sophisticated European system of reckoning longitude and latitude, plotting courses, and fixing precise positions, that 'cruder methods' (Polynesian) could not hope to duplicate on the open sea what western navigation had taken 500 years to develop. He drew a parallel with the many habitable islands in the Atlantic and Indian oceans which had remained 'undiscovered' because, as he believed, they lay further than the 300 mile range of effective navigation from occupied land without modern navigational aids such as the compass. The only exceptions he noted were Madagascar and the Nicobars which he stated lay in the path of some of the most constant winds and currents in the world i.e. they too were settled accidentally (1956:17-20).

He also imputed that the Polynesian oral traditions, reputed to contain accounts of widespread voyaging, were 'folktales' that had been altered and corrupted upon contact with Europeans and that:

..they should be returned to their unedited pristine form. The picture that they give is very different from the suppositions which were based on select extracts from the, later and more sophisticated material (1956:89).

In conclusion of his thesis he wrote:

Obviously the Polynesians had ancestors, and obviously they came in canoes. The only thing that needs to be revised is the manner of their arrival which was by accidental voyages which only the hardiest could

⁹ Sharp's comments concerning the alteration of oral traditions is covered more fully in Part Three.

survive, rather than by supernatural means or their equivalent, deliberate navigation over great distances without instruments.

The actual voyaging of the Pacific Islanders was spectacular enough in itself. The notion that fleets of brown-skinned colonists pushed into and through these islands in the first place impelled by a mysterious urge, is purely mythical, is belied by the evidence, and flies in the face of the well-known facts of the evolution of human cultures everywhere, and the retention of those arts which were to the advantage of the community, as long voyaging would have been for trade and political dominion (1956:90, 161).

The Response to Sharp

Sharp's book caused the academic world to take an interest in the subject of Polynesian navigation. Suggs (1960:83-85) attacked Sharp on the basis that the 'entire presentation of the thesis has more of the aspect of a pet notion than that of a scientifically developed theory'. He took Sharp to task for ignoring contrary evidence and reviewed what was known about Polynesian navigation at that time. He concluded that the Polynesians had a well developed technology which included extremely seaworthy vessels, that empirical navigational techniques did exist, and added that both were supported by archaeological evidence which suggested that the Marquesas and Hawai'i had been colonised by well provisioned expeditions. Others such as Hilder (1962) and Akerblom (1968) took a similar position to Sharp (Irwin 1992:16). The scholarly debate culminated in Polynesian Navigation: A Symposium on Andrew Sharps Theory of Accidental Voyages published in 1962.

One of the respondents, Hilder, was an experienced European sea captain. He based his essay completely on the concepts, requirements and difficulties of the modern European system of navigation. In agreeing with Sharp, he wrote:

In considering the question of what forms of navigation were possibly used by the Polynesians, it

is quite unrealistic to assume that their small and scattered communities could, without mathematics and written records, without sundials, clocks, charts, magnetic needles, astrolabes or sextants of any kind, achieve a better system of navigation than the combined civilisations of Christendom and Islam in the year 1500 (1962:92-93).

In regard to the discovery of New Zealand he commented that its discovery was surely accidental because finding it required a level of knowledge, both of geography and navigation, far beyond what had ever been found in Polynesia (Hilder 1962:97).

In another paper Parsonson argued that the Sharp's resurrection of the accidental voyage theory rested on the inherent plausibility of the theory itself rather than the competency of the recorded observations of the early European explorers and observers utilized by Sharp in support of his argument. He criticised Sharp variously for either omitting facts, or misinterpreting them, and for making selective use of the evidence he presented. He maintained that Sharp's work was unreliable on navigational matters, being too preoccupied with theory rather than fact, and that it exaggerated the difficulties of navigating in the Pacific (1962:24-28).

Parsonson noted that, contrary to Sharp's thesis, the records of several early European observers consistently supported the view that the Polynesians frequently undertook deliberately navigated voyages, often of some duration and over long distances. Sailing absences of several months and longer were recorded. Some were organised expeditions for inter-island raiding. Others were made for purposes of trade in stone or for the pursuit of red feathers. Kau Moala, a Tongan sailor, was reported to have voyaged around Western Polynesia including Fiji, Samoa, Futuna and Rotuma over a fourteen year period. Other Tongans were said to have made round trips of up to 1,000 miles. Atoll dwellers, including the Tuamotuans and Marquesans, had even evacuated whole islands because of drought, famine and other natural disasters. Others left as the result of dispute or out of a sense of

adventure and a desire to see the world, because of disputes over religion, or as punishment for crimes political or otherwise. In the seventeenth and eighteenth centuries the Tongans had ranged over the seas between Fiji, Samoa, Uvea, Niue, Tokelau, Tuvalu, Rotuma, Tikopia, Sikaiana, the Gilbert, Banks and Duff islands. In Eastern Polynesia the Tuamotuans seemed to have frequently sailed long distances. Voyages between Tongareva and Rakahanga had only ceased in the mid-nineteenth century. The Society Islanders had been known to travel to the Tuamotus, Cook and Austral islands. Perhaps, more significantly, among the Polynesian Outliers mariners were known to have voyaged the 840 miles, without intervening islands, between Taumako and Nukulaelae and to have made the 1,270 mile journey, with only one intermediary stop, between Sikaiana and Fiji. Parsonson also noted that in many of the reports of drift voyages there was mention of the survivors having sailed great distances back to their islands of origin. One such trip included a voyage of 1,000 miles, from New Ireland to Ocean Island (1962:28-35, 46-50).

He also argued that the Polynesians possessed the maritime technology to achieve what the traditions claimed had occurred. Cook's *Endeavour* measured 106 feet by twenty-nine feet and this was comparable to the dimensions of many Polynesian vessels encountered as attested by early Europeans. Cook himself recorded a Tahitian hull 108 feet long, and Fornander (1880) a Hawai'ian hull of similar dimension. The missionary Thomas Williams (1870) recorded a *ndrua* measuring 118 feet by fifty feet long with a mast sixty-eight feet high. The European ship the *Glide* saw double hulled canoes in Fiji carrying between 300 to 400 men. In 1774, while in Tahiti, Cook recorded an armada, including 160 large war canoes, 170 sailing canoes, and a multitude of smaller vessels carrying 7,760 warriors (1962:36-37).

Parsonson quoted from observations of the sailing qualities of Polynesian canoes. Cook (1785), Robertson (1948) and Wilkes (1845) all witnessed canoes sailing faster than their own ships. Many canoes were recorded sailing between twelve to sixteen knots

and some were estimated at even up to twenty-two knots. In terms of manoeuvrability Bougainville (1772) in Samoa and Cook (1785) in Tonga both stated, in quite separate incidents, that canoes sailed around them 'with the same ease if we had been at anchor' (1962:37-38).

Sharp had also argued that Polynesians were unable to fix their position in terms of longitude and latitude. He claimed that until this capability had been developed by Europeans their sailing was limited in much the same way that Polynesians were. However, Parsonson pointed out several other historic precedents of navigation over long distances of open sea in the absence of that particular technique. The Vikings had overcome the 1,500 miles between Norway and Greenland, and Irish monks the 600 miles from Ireland to Iceland and Scandinavia. The Arabs and Chinese had performed similar feats in the Indian Ocean long before modern navigation was known (1962:24-25). In terms of European scepticism of the Polynesian ability to navigate and in succinct reply to Sharp, Parsonson wrote:

The key to this paradox lies in the fact that a literal society faces the peculiar difficulty that it must be able to set down on paper, in this case maps, charts and almanacs what non-literate folk might easily read in the sky or carry in their heads. In the end it comes to imagine the job can be done no other way (1962:59).

Heyen, another experienced sea captain, acknowledged the logic of Sharp's argument but challenged the validity of much that he wrote. He said that Sharp had failed to distinguish the difference between wave and swell patterns. Wave patterns are localised around islands and changeable whilst swell patterns are long distance and directionally constant over a large area and for long periods of time lasting several weeks or months, and were therefore good long-term indicators of direction. In respect of another assertion by Sharp he wrote that generally the weather conditions in the Pacific did not cause the sun, moon and stars to be obscured for more than three days at a time, and then only during the cyclone season (1962:64-65).

In respect to the settlement of New Zealand by drift voyage, Heyen pointed out that it was unlikely that any sailor, once blown off course, would continue sailing south while conditions were becoming increasingly colder and more difficult. In the same respect it was unlikely that, in similar circumstances, they would continue westward over long distances as this would entail the active pursuit of any westerly storm that had blown them in that direction (1962:65).

He also estimated that waka were capable of making 140 miles a day, and therefore journeys up to 1,000 miles were possible within a ten day span, and that although Polynesian canoes were not as powerful as European sailing ships, they were quicker and trimmer, and could also be paddled in conditions of calm (Heyen 1962:72).

Heyen noted that the majority of Polynesian voyages claimed in tradition had been made in generally southerly or northerly directions, rather than westerly or easterly directions. He surmised that the significance of this was firstly because exploring voyagers would not want to sail directly to leeward with a strong tail wind as they may be unable to make the return against the wind if blown too far. Alternatively they could not sail directly into the prevailing easterly winds. However, they could by reaching across the prevailing trades, ensure a safe and rapid return before the trades when on a return run (1962:75-76).

Much doubt had also been expressed about the ability of Polynesian vessels to sail to windward because their shallow draft and lack of a keel, centreboard or leeboard meant they would be unable to resist leeward drift (Finney 1977:1277). Bechtol (1962:98-101) conducted tank tests on models of Polynesian vessels and found, contrary to what Sharp purported, that 'V' shaped or round bottomed hulled Polynesian vessels, equipped with large steering paddles acting as keels, were capable of sailing within forty-five degrees of the wind (See Fig.9). Others were capable to within sixty to eighty degrees.

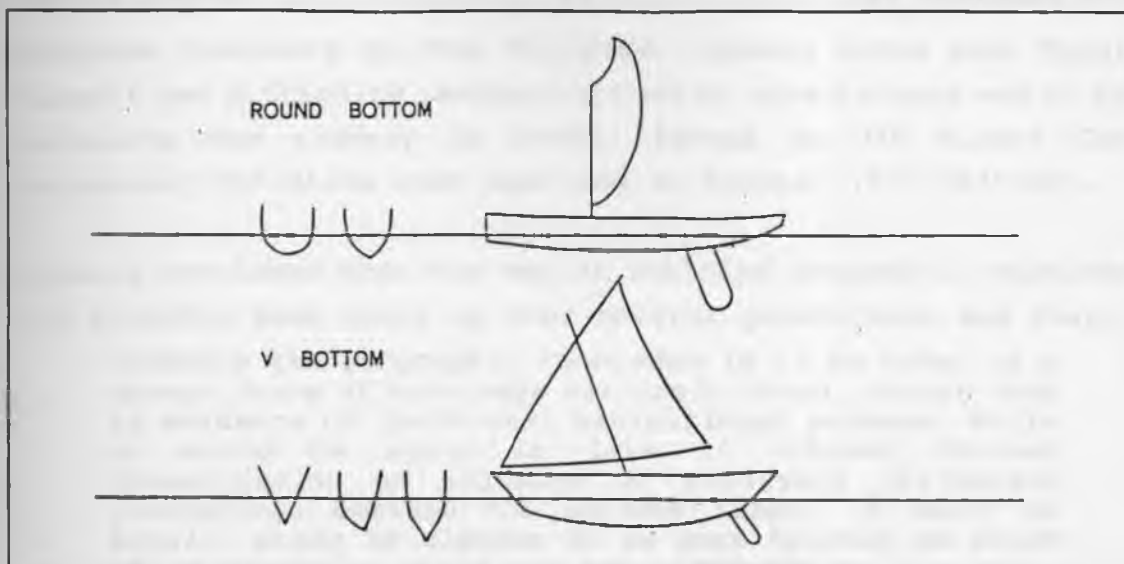


Figure 9: Polynesian Hull Types (Bechtol 1962:99).

Denning re-examined the geographic knowledge of the Polynesians as recorded on lists collected by early European explorers in the Pacific. Seventy-four of the islands on Tupaia's list, as given to Cook, had been mapped, of which forty-five are identifiable. These include islands from all the main groups in Eastern Polynesia (except New Zealand and Easter Island) and many from Samoa, Tonga and Fiji in Western Polynesia. However as noted earlier the Tongan list given to Cook, at a time when he was the first European in their group, included no islands from Eastern Polynesia (1962:102-103, 110). The point Denning made was that:

If we argue that Tahitian knowledge of Samoa came from accidental voyages from the west, then we must explain why the Tongans had no knowledge of East Polynesia, although over 90% of accidental voyages we have mapped come from the east (1962:103).

Other lists collected from the Tahitians support the view that they had a high degree of knowledge of the islands in other groups. These lists include islands in the Tuamotu group as far south perhaps as Ravahere and Hao, up to six of the islands of the Marquesas, and all of the main islands of the Austral and Cook groups except Aitutaki, Atiu and Rapa. Interestingly, Rarotonga appears on several lists collected well before its

European discovery by John Williams. Denning noted that Tupaia himself had difficulty navigating Cook to some islands and on two occasions was clearly in error, though he did direct Cook accurately 350 miles over open sea to Rurutu (1962:103-106).

Denning concluded that the sum of Tahitian geographic knowledge had probably been built up over several generations and that:

Probably the geographic knowledge is to be taken as a common store of knowledge variously known, rather than as evidence of individual navigational prowess. While it would be wrong to take it without further investigation as evidence of wholesale deliberate journeyings between the islands named, it would be equally wrong to dismiss it as mere hearsay on which the Polynesians could not act (1962:106).

Other groups in Eastern Polynesia do not appear to have had the same degree of knowledge as the Tahitians. The knowledge of the Cooks, Marquesas, Australs seems limited to within their own groups although reports from the Marquesas indicate that they:

...were so confident in the existence of land to the west and its luxuriant abundance that they left the Marquesas in great numbers in search of it....Over 800 men, women and children were reported to have left in this way over a short period (Porter cited in Denning 1962:109).

In Western Polynesia Tongan knowledge indicates another important contact area which includes Rotuma, Samoa, Fiji and beyond, and Vaitupu (Tuvalu) 1,000 miles north-northwest (Denning 1962:106-110).

In regard to navigation method, Denning emphasised two important elements as outlined by Varela. They were 'the skilled recognition of natural signs of wind, swell, and weather, and the accuracy of navigation by star bearing'. He added that the many natural signs claimed as indicators of land in Polynesian navigation were also all utilised by early European explorers in the region (1962:113).

The annual flight path of migratory birds was regarded as a sign

determining the direction of distant land. The long tailed cuckoo, godwit, and shining cuckoo all migrate to New Zealand, from Eastern Polynesia, Central Polynesia, and Western Polynesia during the months of October and November, which incidently is now recognised as the best time to sail when making that trip. The bristle-thighed curlew migrates from Tahiti to Hawaii (Denning 1962:114-115).

Once the direction of land was identified it was then possible to determine a course in relation to celestial signposts. Other aids were used to make landfall. The morning and evening flight paths of land birds fishing at sea indicated nearby land. At sea land masses are detectable, at distance, because of changes in swell patterns which are broken up by island masses. At night land breezes may carry the scent of land at some distance especially high esplanade islands such as Tahiti. Drift wood and seaweed are also indicators. Clouds over islands and lagoons are also distinguishable. Often they are stationary and or tinted with the reflection of the lagoon or trees (Denning 1962:114-117). In conclusion Denning wrote:

When we are talking of the primitive craft of the Polynesian navigator we are not talking of the absolute value of any one or other of the methods used but rather the cumulative value of the evidence which the natural signs give of the direction of land. Nor are we talking of methods which will give pinpoint accuracy, but only of methods which bring the navigator within sufficient distance of his landfall for him to use the signs of birds, winds and swells (1962:116).

Polynesian navigation, as Denning viewed it, incorporated a methodology based on combined elements involving the utilization of astronomical knowledge, wind and swell patterns in conjunction with other indices in nature, which had been under appreciated by Sharp in the fullest context of its use.

Denning compiled a list of sixty-two recorded deliberate voyages. He concluded that there were a number of contact areas within which voyages over 1,000 miles were made although the longest

stretches over open water were about 350 miles and generally averaged between 150 to 230 miles. The main contact areas were the Society-Tuamotu groups, within the Society group itself, the Southern Cooks, Tonga-Samoa, Tonga-Fiji, Tonga-Rotuma and the islands to the north. Evidence of deliberate voyaging between contact groups was minimal. He also compiled a list of 152 recorded accidental voyages, the vast majority of which occurred within contact groups rather than between them. He also noted that mention of accidental voyage occurred in the traditions of New Zealand, Hawai'i, Tahiti, Nassau, Pukapuka, Tubuai, Raivavae and Rarotonga. On the basis of this evidence he proposed that they must have played at least some part in the settlement of Polynesia (1962:125-126, 128-131, 138-153).

The Need for Empirical Research

After the Symposium on Polynesian Navigation in 1962, a call went out for new data based upon empirical experience because the debate had thus far relied heavily on the records of early European observers in the Pacific. These, however, contained little if any reference to the specifics of Polynesian navigational concepts in practice. During the early contact period only two Polynesian navigators, Tupaia a Ra'iatean and 'Pedro', a Sikaianian prisoner in Taumako, had ever been interviewed at length and neither had provided any precise details pertaining to navigational method (Lewis 1976:16-17). The twentieth century debate had not breached this gap in the data and had therefore been largely conducted on an almost entirely theoretical basis, hence the need for what Finney (1976:6) described as 'new non-armchair research'.

Initial studies took place among the islands of Micronesia and the Polynesian Outliers where traditional voyaging techniques were still being practised (Finney 1976:7). Scholars such as Gatty (1960) and Frankel (1962, 1963) presented detailed analyses about applied Polynesian astronomical knowledge in navigation

(Lewis 1964:364-368). Alkire (1965) and Gladwin (1970) undertook intensive investigations of Pacific maritime technology, including canoes and navigation on the Micronesian atolls of Woleai and Puluwat (Finney 1976:7).

Doran (1976:29-45) conducted research aimed at obtaining exact information regarding the sailing ability and performance of traditional outrigger canoes in Micronesia. He used modern instruments to measure wind speed and angle, boat speed, and leeway angle. He also found that the hulls were well shaped, with nearly ideal length to beam ratios although the sail rigs were inefficient under some conditions. Despite that, he concluded that they had 'excellent speed and performance, seaworthiness, and general voyaging capacity' and were 'remarkably good in performance when compared with modern yachts'.

Another important aspect of the work undertaken during the 1960s and 1970s was sailing alongside Micronesian and Polynesian navigators and recording how they sailed. In 1969 Lewis (1976:15-27) sailed 18,000 miles in his ketch the *Ishborjn* while researching traditional sailing methods. 1,800 miles of this was sailed under the direct guidance of traditional navigators. Two legs of this trip were of 450 miles without intervening islands and over which Lewis noted that Hipour, his navigator for the trip, navigated with an error of just five miles.

Levison, Ward and Webb (1976:61-68) addressed the question of the settlement of the Polynesian Outliers. They developed a computer simulation which took account of recorded weather conditions, and persuaded most scholars that the major colonising voyages of the Pacific could not have occurred by drift, even if the methods that had been used were unknown. According to their study accidental drift voyages could not have accounted for the initial movement from West to East Polynesia, and that drifting canoes had no chance of reaching Hawai'i, Easter Island, or New Zealand.

Others including Lewis (1972), Finney (1977), and Siers (1977)

began re-establishing the reputation of ancient voyagers by embarking on experimental voyages and building replica canoes (Irwin 1992:16). This renaissance continued into the 1980s and 1990s with voyages by vessels such as the *Hokule'a* from Hawai'i (Finney 1991), the *Hawakinui* out of Tahiti and New Zealand (Whakataka-Brightwell 1994), and *Te Aurere* from New Zealand (Conrad 1995).¹⁰ In summary of the new era Finney wrote:

It is apparent, for example, that the Micronesians and Polynesians, and perhaps some of the peoples of Melanesia, shared a unique deep-sea adaption. With their many types of ocean-going canoes, their use of the stars and other natural phenomena for navigation, and their sensual and emotional familiarity with the sea, these Pacific Islanders were able to treat the ocean as an avenue, not a barrier, to communication. They were not, however, conquerors of the sea. Adaption, not conquest, is the appropriate term to denote how they had learned to travel through the Pacific, for voyaging and navigation was (and still is for some) a matter of man adapting his technology and life style to the winds, stars, swells and other aspects of his oceanic environment (1976:9).

Summary

Historically the debate over Polynesian navigation had fluctuated between the position of acceptance of the Polynesian ability to navigate, largely based on early European accounts of what they observed during the period of first contact and immediate post-contact era, and that of accidental voyaging based on alternative interpretations of much the same evidence. A third position emerged as argued by Denning (1962), that both elements had contributed to the settlement of Polynesia. At this stage in the debate, although the occurrence of accidental voyages was acknowledged, the weight of opinion tended to support the idea that the Polynesians had indeed been capable deep sea navigators. It is also worth noting that Sharp's view on the usual range of voyaging is in accordance with what is suggested by the

¹⁰ The era of modern voyages in replica canoes is reviewed more substantially in Part Two.

archaeological evidence outlined in Chapter One. Much of the content of the argument against Sharp also suggests that the majority of voyaging occurred within island groups. Where the affirmative position on navigation differs with Sharp is in its estimation of navigational skill and ability, and effective range. However it is important to note that having the ability and technology to deliberately navigate over extremely long distances does not necessarily mean that early Polynesians did so frequently or at all. Such practice would seem to be the exception rather than the rule.

Three important issues remained outstanding. Firstly, no one had yet ventured to throw away the compass and go sailing. Secondly Polynesian navigation methods had still not been scrutinised sufficiently, point by point, in order for a more adequate level of close empirical analysis to be attained. And, thirdly, although there was a general agreement by all those involved in the debate that the Polynesians could sail around the islands within their respective groups, no one as yet had determined the extent, limit, and effective range of Polynesian navigation.

THE RENAISSANCE OF POLYNESIAN VOYAGING

CHAPTER THREE

WEATHER PATTERNS IN THE PACIFIC

Before analysing the voyages of the modern renaissance of Polynesian navigation, it is important to examine the predominant weather patterns in the Pacific. Successful navigation of any kind depends on a good level of knowledge and understanding of weather, and an ability to sail and cope with any variations that the weather might present. During the current revival of Polynesian voyaging, many 'new' navigators spent much time at sea, on shore, in planetariums, universities, and meteorological offices, in order to improve their understanding of weather. Previously their knowledge base had been almost non-existent because of the earlier decline in traditional navigation. The brief overview provided in this chapter is useful as a background for clarifying much of the material presented in Chapters Four to Eight.

Predominant Weather Patterns

The Pacific is the largest and deepest body of water in the world. It covers an area of 61,800,000 square miles, or about one third of the earth's surface, and is on average 14,000 feet deep (Lindo 1986:80).

The predominant easterly winds in Polynesia and the westerlies that sweep over New Zealand are part of a wider global pattern

generated by the differential solar heating of the planet by the sun (See Fig.10). Maximum solar heating occurs at the equator where warm air rises, and splits into two upper air streams, one of which flows northward, and the other which flows southward. Both move toward the poles, becoming cooler as they go, and then descend to the surface in the latitudes of thirty degrees north and thirty degrees south. Some of this air moves back toward the lower pressure areas of the equator, although not directly so. The earth's rotation to the east (the Coriolus Force), coupled with the increasing circumference of the globe towards the equator, causes the air flow to twist toward the west. In the Northern Hemisphere this creates northeasterly winds running towards the equator, and in the Southern Hemisphere southeasterly winds toward the equator. Jointly these winds are known as the 'trades'. Not all the air that descends earthward at the latitudes of thirty degrees north and thirty south returns toward the equator. Some flows towards the poles, where it is twisted eastward by the Coriolus Force acting in conjunction with the decreasing circumference of the earth, thus creating the mid-latitude westerlies. At the same time cold, dense air from the poles, flowing towards the equator, is forced to its right by the earth's rotation, thus creating the polar easterlies. At about sixty degrees latitudes north and south, this air meets the mid-latitude westerlies causing some of the surface air to rise and then split at high altitudes where one part flows back towards the equator and the other back towards the poles (Finney 1991:IV:5-7; Irwin 1992:9).

The general flow of air around the earth is divided into bands within which climatic systems build and dissipate. These bands change their boundaries with the seasonal passage of the sun. These factors, the heating and cooling of air over large land masses, and other localised factors combine to form 'weather'. The wind patterns, the rotation of the earth, and the presence of land masses also combine to create the pattern of currents (See Fig.11)(Irwin 1992:9-10).

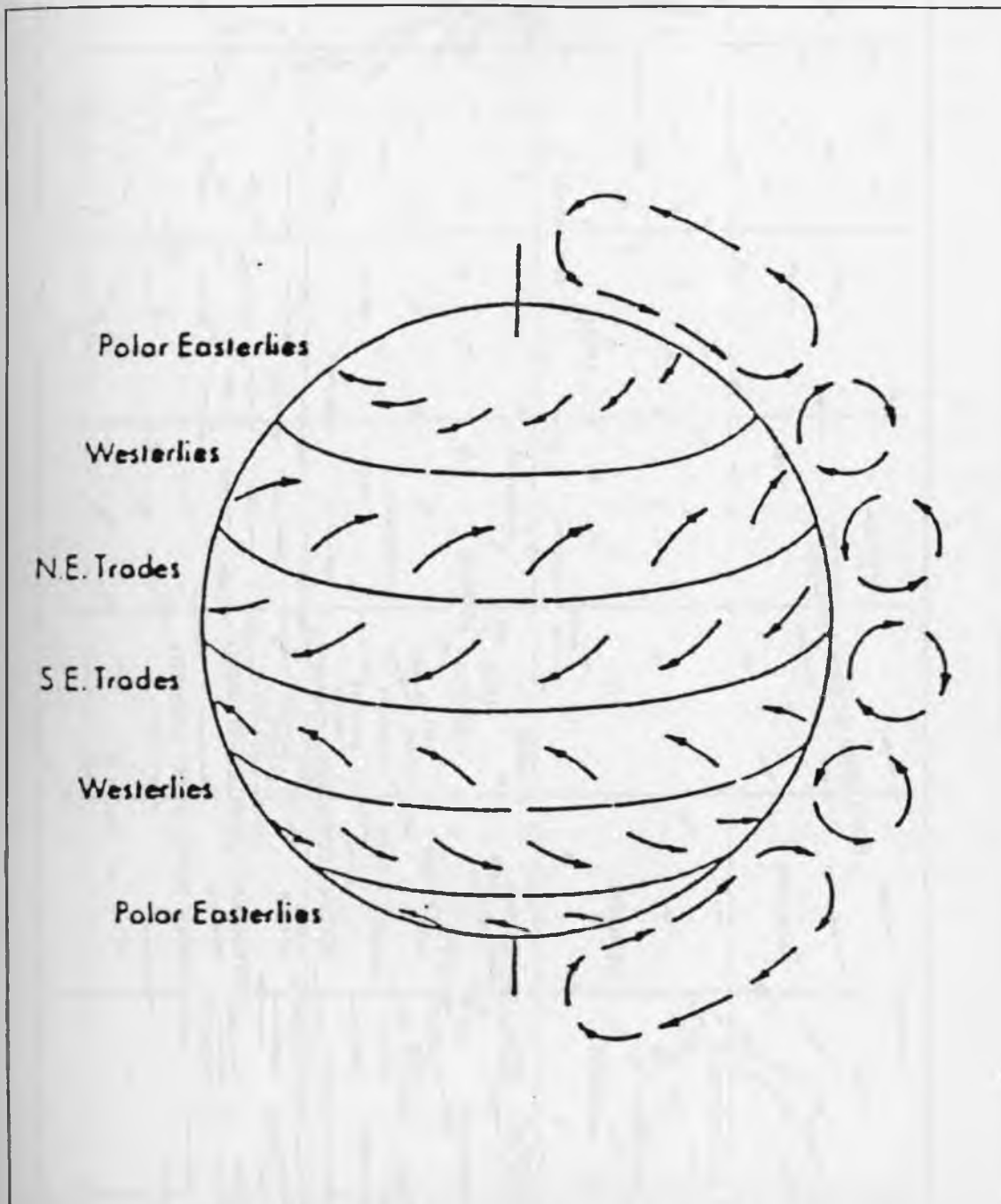


Figure 10: Global Convection Cells, and Predominant Wind Patterns in the Pacific (Finney 1991:IV:4, 7).

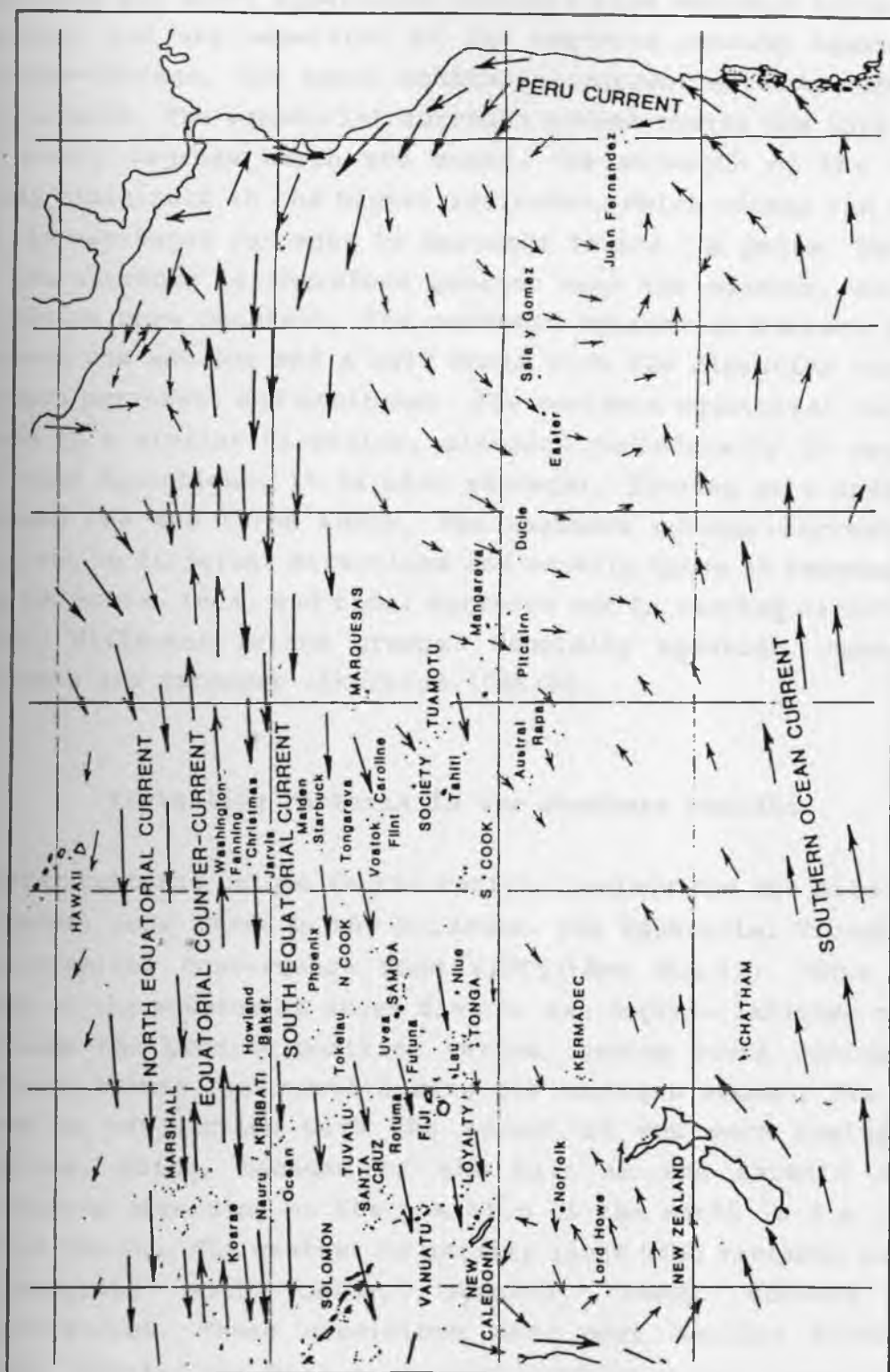


Figure 11: Predominant Currents in the Pacific Ocean (Irwin 1992:11).

The north and south equatorial currents flow westward across the Pacific, and are separated by the eastward setting equatorial counter-current. The south equatorial current extends north of the equator. The equatorial currents extend toward the latitudes of twenty degrees north and south. The strength of the trade winds diminishes in the higher latitudes, which causes the speed of the westbound currents to decrease toward the poles. The set of the currents is therefore greater near the equator, and the direction more constant. The northern equatorial current flows between one and one and a half knots with the direction varying between northwest and southwest. The southern equatorial current flows in a similar direction, although periodically it may set in other directions. It is also stronger, flowing at a speed of between one and three knots. The eastward counter-current can also set in different directions and usually flows at between one and two knots. Local and tidal currents set in varying directions within different island groups. Generally speaking, open sea currents are stronger (Akerblom 1968:56).

Prevailing Patterns in the Northern Pacific

Weather patterns unique to the Pacific include the 150 mile wide permanent zone known as the Doldrums, the Equatorial Trough, or Intertropical Convergence Zone (ITCZ)(See Fig.12). This lies north of the equator at above five to ten degrees latitude north although the precise position varies, moving south during the southern summer, and north during the northern summer. The ITCZ moves in conjunction with the amount of sun each hemisphere receives, which, because of the tilt in the earth's axis, fluctuates according to the position of the earth in its orbit around the sun. The weather is usually light with variable winds, interspersed with calms, squalls, heavy showers and thunderstorms. These conditions make most sailing difficult (Irwin 1992:11, 13, 24).

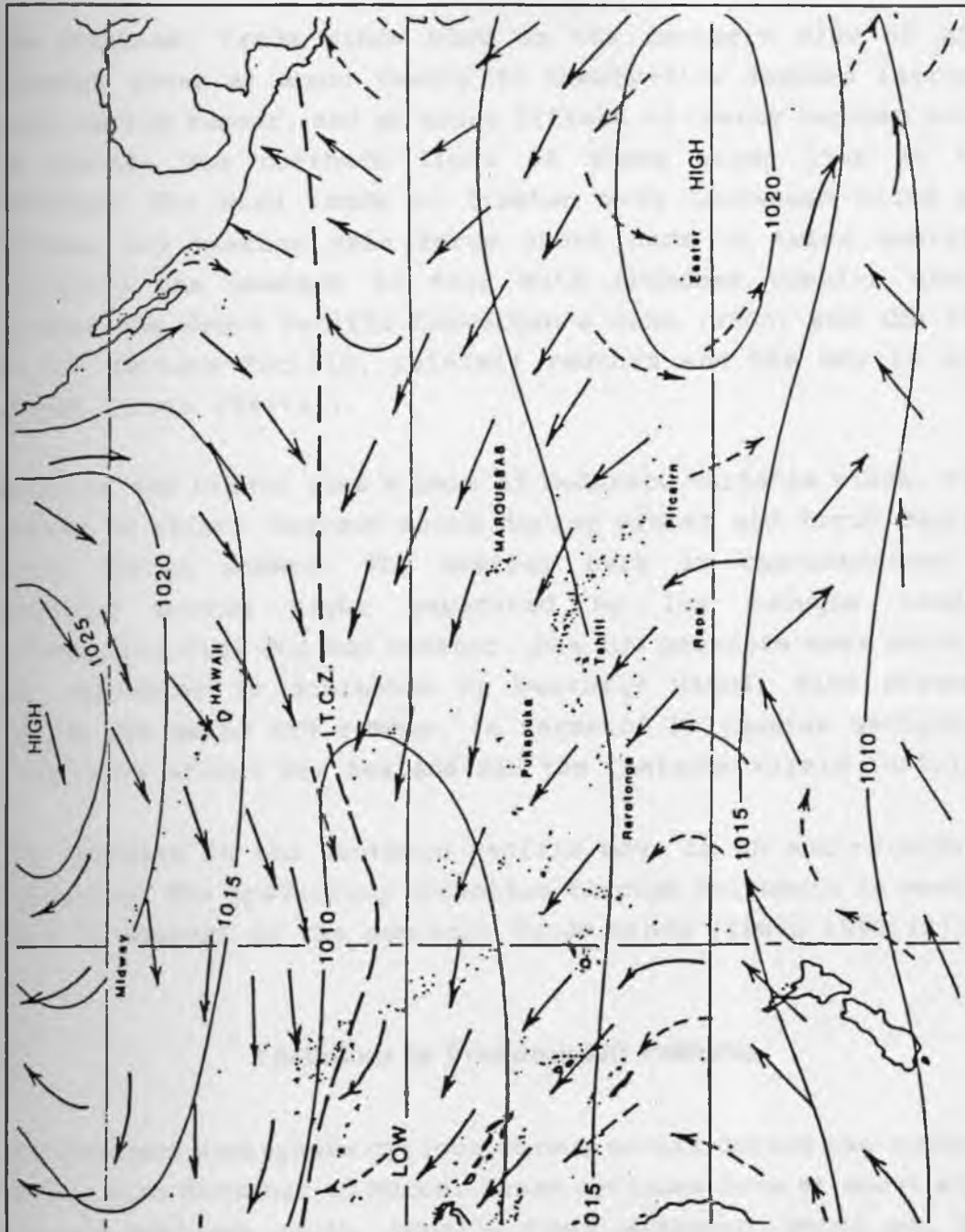


Figure 12: Intertropical Convergence Zone (Irwin 1992:10).

Prevailing Patterns in the Southern Pacific

The southeast trade winds blow on the northern side of high pressure areas at about twenty to twenty-five degrees latitude south during summer, and at about fifteen to twenty degrees south in winter. The northern limit of these winds lies at the doldrums. The wind tends to freshen with increased cloud and showers and reaches gale force about once or twice monthly. Typically the weather is fair with abundant cumulus cloud. Between the South Pacific Convergence Zone (SPCZ) and the ITCZ in the Eastern Pacific, rainfall reduces and the sky is more cloudy (Irwin 1992:11).

South of the trades lies a belt of moderate variable winds. They extend to thirty degrees south during winter and forty degrees south during summer. The weather here is characterised by easterly moving highs separated by low troughs causing alternating fine and bad weather. The low pressure area south of the variables is dominated by westerly winds. Wind strength varies and gales are common. In terms of Polynesian navigation these only affect New Zealand and the Chathams (Irwin 1992:12).

The currents in the Southern Pacific move in an anti-clockwise direction. The prevailing direction through Polynesia is east to west in support of the dominant trade winds (Irwin 1992:12).

Variations in Predominant Patterns

The Southern Hemisphere cyclone season occurs during the southern summer from November to March. These cyclones form at about eight degrees latitude south, usually track westward, south and then east. They frequently occur north of New Zealand. During the same period the ITCZ is situated north of Australia, in a low pressure area, having been pulled south by the sun. In addition to this, warm air rises off the land mass of Australia causing the

northeast trade winds from the western side of the North Pacific to be drawn across the equator, and deflected in a more northwesterly direction. These monsoonal northwesterlies are particularly strong north of Australia and in Melanesia. The monsoonal change in wind direction facilitates sailing in a westerly direction, although further east the more the northwesterlies ease. These have an affect on voyaging as far west as Tahiti (Irwin 1992:12, 24).

In respect of sailing east against the prevailing winds, another source of westerly winds are intermittent rotational weather systems which move west to east, south of the equator. Southern low pressure systems may also have accompanying troughs reaching north of the SPCZ enough to cause changes in the prevailing easterly wind pattern. These troughs lie in the deep south during the southern winter. The pattern known as *El Nino* also brings westerlies into the tropics (Irwin 1992:13).

Once or twice in a decade, warm equatorial flows move down the coast of Peru, smothering the colder nutrient rich water usually present. This has a devastating effect on marine life, birds and fishing. These periodic disturbances usually occur around Christmas, and are known as *El Nino* (The Christ Child). These changes are part of a basin-wide change in ocean and atmospheric conditions known as the Southern Oscillation. Typical of this phenomenon is a reversal in the usual atmospheric gradient across the Pacific with a high in the east and a low in the west. This manifests itself in a weakening of the trade winds, and a prolonged period of westerlies. With the weakening of the trades the sea level in the west lowers and that in the east rises. This causes the flows, that wash out the cold water on the coast of Peru. The westerlies associated with *El Nino* are usually strongest in the western and central Pacific. During 1987 a comparatively mild *El Nino* sent westerlies as far east as the western side of the Society Group. However, in 1982 to 1983 a particularly large *El Nino* spread over most of central East Polynesia and beyond (Finney 1991:VIII:10-11).

Voyaging Scenarios

In order to understand Pacific weather patterns and their affect on navigation it is useful to explore some of the possible routes that might have been sailed by ancient mariners between the islands of Polynesia.

West Polynesia and the Polynesian Outliers

The westernmost island of Polynesia is Nukuria, a small atoll northeast of New Guinea between New Britain and Bougainville. Several other outliers such as Kapingamarangi, Nukuoro, Rennell and Bellona are hundreds of miles west of Tonga and Samoa. The popular concept of the 'Polynesian Triangle' running from West Polynesia, to Hawai'i, Easter Island and New Zealand is, at least in part, a misconception. True Polynesia spans nearly one quarter of the globe from Nukuria at 155 degrees longitude west, to Easter island at 109 degrees longitude east. Two scenarios exist pertaining to the peopling of the Polynesian Outliers: the first suggests that some Polynesians returned westward deliberately, and the second, that they were peopled as the result of accidental voyages (Finney 1991:VIII:34-35). Both are entirely feasible, because the outliers lie downwind of the predominant trades. However, most of the furthest western outliers would have been difficult to return from, because that would have meant tacking into the trades over long distances, unless of course variations in wind patterns were known and exploited.

West Polynesia and New Zealand

During November and March, conditions are favourable for a crossing to New Zealand. There are few gales and storms and minimal displacement caused by current set. A canoe could easily sail across the southeast trades sufficiently far to run with the

prevailing westerlies of the more southern latitudes. With favourable conditions, this crossing could be made in nine to ten days. The return could be made during autumn and spring by running northeast across the westerlies and then north or northwest with the southeast trades (Heyen 1962:74-75).

Although easy from Tonga, a similar voyage attempted from Fiji would prove difficult because of the more direct southerly course. Winter conditions would be dangerous, and during the summer the almost direct southerly course would require sailing with strong westerlies abeam, which could push the canoe too far east. Alternatively a southwest tack would carry a canoe too far west (Heyen 1962:75).

West Polynesia and East Polynesia

Voyages between Samoa and Hawai'i are unlikely. An initial leg through the southeast trades would stand the canoe too far westward to make good progress against the northeasterlies in the Northern Hemisphere. A reverse passage would be easy. A canoe could sail south with the northeast trades and then east with the southeast trades. The equatorial currents would also aid this passage. Generally, passages from east to west are easier than those from west to east. Voyagers wishing to go west to east would have to cover extra distance in tacking, or attempt to use westerly variations in the predominant weather patterns (Heyen 1962:75).

East Polynesia and New Zealand

This passage is more difficult than sailing from East Polynesia to Hawai'i, or from some parts of West Polynesia to New Zealand. The main problem is that it involves sailing out of the trade wind zone into the fierce westerlies of the Southern Hemisphere. Additionally, the weather, seas and winds, are much colder.

Certainly the flight paths of migratory birds may have told Pacific island Polynesians that land did lie to the south. A winter voyage would be extremely dangerous and a summer voyage difficult, but not impossible, as summer highs might periodically replace the prevailing westerly winds with northeasterlies (Heyen 1962:74; Finney 1991:VIII:32-34).

The Marquesas and Hawai'i

There is a distance of 1,800 miles between the Marquesas and Hawai'i, and a lack of islands in between that could serve as staging posts for voyagers. However, a voyage from the Marquesas to Hawai'i may have been relatively easy because of the favourable alignment of the trade winds. The route would involve making a broad reach before the southeast trades, and then again across the northeast trades. The passage might take two to three weeks (Heyen 1962:73; Finney 1991:VIII:27-28).

On the other hand, a voyage from Hawai'i to the Marquesas would have been more difficult, and would certainly have taken more time. However, it would not have been impossible. It would involve sailing across the northeast trades and then tacking almost straight into the southeast trades in order to make the 900 miles easting required to reach the longitude of the Marquesas. The journey may be possible during winter when westerlies or northerlies could be used to get a boost toward the east. During November to March the northeast trades can sometimes extend further south which might even carry a canoe all the way. However, the weather would be much stormier, and the winds more variable, meaning that this option could involve added risk and would necessarily require a detailed knowledge of the variations in weather. Alternatively, a course could be set to the Tuamotus which lie at a better angle in relation to the southeast trades. From there a reach could be made across those same trade winds to the Marquesas (Finney 1991:VIII:30-31).

Easter Island and East Polynesia

Easter Island lies 2,300 miles from the South American coast, 1,900 miles directly upwind from the Marquesas, and 1,100 miles from Pitcairn and Henderson, the closest islands settled by the Polynesians. East Polynesian voyagers from the Cooks, Societies, Australs or Tuamotus to Easter Island may have exploited winter westerlies to reach there, although the rougher weather may have been hazardous. Stopovers in Mangareva and Pitcairn would have been useful for relief from the weather, repairs and rest. Modern yachts sail to Easter Island in this manner. Summer westerlies, although milder would probably be not be strong enough to carry a canoe that far east. Another option is that *El Nino* westerlies could have been used although these would have been extremely rare. Certainly a voyage from the Marquesas would have been improbable, except during a particularly strong *El Nino* period. Such conditions did exist during the 1982 to 1983 *El Nino*. In fact an especially strong *El Nino* could have blown voyagers there against their wishes. A third scenario is that voyagers may have chanced upon Easter Island while exploring the westerlies of the more temperate latitudes below the tropics. European sailing vessels used the 'roaring forties' between forty and fifty degrees south in order to reach Chile. However, the more open style Polynesian canoes would have had great difficulty in the cold. In order to reduce this risk voyagers could have attempted to sail along the edge of the westerlies at between thirty to forty degrees latitude although the winds may be too inconsistent in this zone (Finney 1991:VIII:21-23).

Polynesia and the Americas

Finney (1991:VIII:35-36) notes much archaeological evidence from the continental coastlines of Australia, North and South America that is associated with Polynesia including fishhooks, adzes,

food pounders, war clubs and other artifacts.¹¹ He suggests that if any contact occurred with the Americas then a simple theory might explain that contact better than a more complex one, that is, that a balsa wood craft, known to have been used on the coasts of South America, may have drifted into Polynesia. Such was the example set by the *Kon Tiki*. However a return from Polynesia to South America on such a craft would probably be impossible.

Alternatively, Polynesian explorers could have exploited *El Nino* which at its strongest may be sufficient to have reached South America. Again, this would have been a very rare occurrence. Probably it would have been easier to sail from Hawai'i to North America, than from anywhere else in Polynesia to South America. During the northern summer it would have been fairly easy to sail north from Hawai'i into the westerly belt of the Northern Hemisphere. The winter westerlies are lower in latitude but more stormy. These westerlies would be needed to sail the 3,200 to 3,500 miles which would take about five weeks. There is some archaeological evidence for human presence on Necker Island, at twenty three degrees latitude north, just 500 miles short of westerly belt (Finney 1991:VIII:39-42).

Another point in favour of some contact, is that Hawai'ians may have deduced the presence of land to the east because of the flight paths of migratory birds. The Pacific golden-plover, the bristle-thighed curlew, and ruddy turnstone all migrate from Hawai'i and other places in the Pacific en masse to Alaska. Some of them are known to stop over in the Marquesas (Finney 1991:VIII:29-30).

¹¹ See also Bryan (1963); Robinson (1942); Friederici (1929); Hornell (1945); Imbelloni (1930); Ramirez (1990, 1991); Skinner (1931); and Thorpe (1929).

Summary

Generally speaking the predominant easterly winds of the Pacific make voyages sailed from east to west relatively easy. The returns however are relatively difficult especially if over some distance.

Direct north to south passages that cross different wind zones are also difficult, because either one part of the passage requires tacking into a head wind, or because the canoe would have to be sailed very close to the wind.

Courses sailed north to south along southwesterly headings, and those sailed south to north on northwesterly headings are relatively easy because they favour assistance from the trade winds. Those sailed on direct northeasterly or southeasterly headings are difficult. It seems possible that many of the difficulties may perhaps be overcome if one possesses an adequate knowledge of the seasonal variations in predominant patterns.

CHAPTER FOUR

REHU MOANA

One of the most noted researchers of the new era of empirical research into Polynesian navigation was David Lewis (1964, 1966, 1972, 1976). He gathered much of his material firsthand at the side of Pacific navigators such as Tevake, from the Polynesian Outliers in Santa Cruz; Hipour and Ikeeliman from Puluwat in the Carolines; Ve'ehala and Ve'etutu from Tonga, and other mariners from West Polynesia, the Polynesian Outliers, and Micronesia. Except for a few navigators from the Outliers, and other parts of Western Polynesia, the majority of Lewis's informants were Micronesian. This was due to traditional Polynesian navigation having either declined or ceased much earlier than that of the Micronesians. Consequently the Micronesian navigation system and its companion sailing lore were relatively more intact. Despite the decline, and the limited amount of extant Polynesian material, Lewis found no significant difference between the two systems (Lewis 1972:6-12, 27, 35-38, 127, 162; 1976:15-28).

Tahiti to Rarotonga 1965

Lewis compiled his research of Polynesian navigation by sailing among the islands of Micronesia, the Polynesian Outliers, and Western Polynesia at the side of knowledgeable Pacific navigators. Subsequently, between November to December 1965, he tested what he had learned by sailing his catamaran, the forty

foot *Rehu Moana*, 2,239 miles from Tahiti, via Huahine and Rarotonga, to New Zealand in an attempt to retrace the approximate route of the East Polynesian migration to New Zealand. All modern navigational aids, time pieces, barometers or thermometers of any kind were stowed away except for an Admiralty chart and a book containing star maps and a table of the sun's bearings.¹² In case of an emergency a companion, Priscilla Cairns, kept a private log of the course using a sextant and deck watch (Lewis 1966:85; Sharp 1966:231-232).

The *Rehu Moana* departed from Tahiti, on the first leg of their journey to Huahine, on the morning of September 24th. The stars and sun were obscured by cloud so their course was maintained by keeping at a fixed angle to the wind and swell. That night the canoe hove to because rain and pitch-black darkness made it difficult to read any stars for sufficiently long periods required to take bearings. The swell patterns had also become difficult to read. The following morning Lewis was able to recalculate their position by the constellation of Orion and landfall was made. The *Rehu Moana* had sailed the 100 miles in twenty-seven hours, eight of which had been hove-to (See Fig.13). The following day a motorised inter-island ship made the same journey in twenty hours (Lewis 1966:86-87).

The 560 mile second leg from Huahine to Rarotonga included a 400 mile stretch without intervening islands. The yacht left on the morning of October 4th setting a course heading twenty degrees left of the setting sun; then at night steering nine degrees left of Venus for three hours followed by eight degrees to the right of the tail of Scorpio. At sunrise the next day they kept the sun twenty-seven degrees right of stern. Latitude was calculated by using two zenith stars, one a small star near Fomalhaut and another rising to its zenith towards morning near Arneb. Both were stars whose paths passed over Rarotonga. They became more useful as ciphers on the third night having previously been

¹² Gatty, H. 1943. The Raft Book New York, George Grady Press.

obscured by cloud and dimmed by the light of a full moon. The speed and distance covered, calculated by dead reckoning, was underestimated and the *Rehu Moana* overshot her second leg objective (Lewis 1966:87-89).

On Friday 8th Lewis estimated their position at fifty miles from Rarotonga, however, no land was visible. That evening a frigate bird and a brown booby were observed flying together so it was decided to wait until dusk and observe what direction they would fly off to. However, when finally they did break for land one flew southwest and the other went westward. The significance of this was disregarded (Lewis 1966:89).

Lewis then took a latitude reading by lying on the deck of the boat and sighting up the mast. His reading was later found to be in error by only twenty to twenty-five miles. He still did not know how far they had overshot Rarotonga. The *Rehu Moana* then encountered an unexpected secondary swell from the northeast and eventually Lewis had to consult the independent navigator who explained that, because of the underestimation of their speed, they had sailed some seventy miles further than calculated and that their next likely landfall might well be in Tonga. They were then able to work out that the previous night they had been situated midway, ten miles equi-distantly, between Atiu and Takutea. The frigate and booby had each returned to its own island. An experienced Polynesian navigator would probably have appreciated the events of the previous night (Lewis 1966:89).

Altering course the following day they sighted an odd looking lenticular cloud at thirty miles distance. They had reached Rarotonga having voyaged 600 miles in six days and experienced thirteen changes in wind and six changes in swell. Despite these changes and overcast skies they had generally been able to correct their course by intermittent star or sun readings. Their latitudinal readings had been excellent and their dead reckoning of distance in error by about ten per cent (Lewis 1966:90).

Rarotonga to Aotearoa 1965

On November 14th the *Rehu Moana* departed Rarotonga. Lewis already knew of the traditional accounts which said that Kupe had left instructions in 'Hawaiki', to 'sail a little to the left of the setting sun in November', in order to reach Aotearoa. He intended to test the validity of those directions and, using the stellar map guides mentioned earlier, plotted an 'S' shaped course for New Zealand heading south of the direct route aiming to reach a position south of the zenith star Phact, which passes over the North Cape. The intention then would be to steer directly westward toward New Zealand (Lewis 1966:90).

Taken from zero degrees north, the course from Tahiti to New Zealand gave Lewis a target bearing from the North Cape, at an angle of 240 degrees on the horizon from Ra'iatea, to Bluff at 227 degrees in the deep south. A direct course to the Bay of Plenty, where traditionally canoes such as the *Tainui* and *Te Arawa* were said to have landed, lies at 233 degrees. Adopting this as a target area gave the *Rehu Moana* a margin of error, that is a margin of safety, of thirteen degrees from the North Cape to Bluff. Furthermore, during early November the intended time of departure, the setting sun bears 254 degrees (sixteen degrees south of the equator) from Ra'iatea and 243 degrees (twenty-seven degrees south of the equator) from North Cape in early December. It was possible, therefore, to set an approximate bearing, as a middle reference for running southward, according to the setting sun at 248 degrees (Lewis 1964:371).

The *Rehu Moana* departed Rarotonga on November 14th. For two days they stayed within sight of Rarotonga until the strength of freshening trades carried them south-west. Before Rarotonga disappeared over the horizon they were able to maintain course by keeping the yacht in line with the Rarotongan mountains Ikurangi and Te Munga. Then as Lewis wrote:

...we headed 16 degrees left of the setting sun, 10

degrees left of Venus with the Pleiades astern. Towards morning the Southern Cross rose 5 degrees forward of the beam and Castor and Pollux were astern. The rising sun stood 54 degrees to the right of the stern. The sun bearings changed with the date and our latitude while the stars remained unaltered only rising 4 minutes earlier each night. An angle of 15 degrees was taken as the span between thumb and middle finger, with the fingers relaxed and the arm extended. The tip of the index finger at arms length measured 1 degree (1966:90-91).

Within one week flying fish appeared, followed by New Zealand rain birds and a single albatross. Their passing by the Kermadecs was confirmed by the sighting of noddies and a short-tailed shearwater on November 29th (See Fig.14). Because they sighted far fewer birds they assumed they were either too far west or too far east but were unsure as to which. Lewis chose to assume a western track because a south-east heading lay more within the safety margin required to strike New Zealand. Adjusting their heading to the south-west, from a mistakenly assumed eastern position, could have meant missing the North Cape altogether and heading on into the Tasman. In terms of ensuring success it was more imperative that they navigate with a view to accommodating a range of possibilities rather than risk all on a single probability (Lewis 1966:92).

Lewis calculated latitude by the zenith stars Adhara, at twenty-nine degrees latitude south, and Phact, at thirty-four degrees and thirty minutes latitude south. While still in a more northerly position this was achieved by sighting other stars directly above the catamaran and then estimating how many degrees north or south of the two reference stars they were. On the nights of December 2nd and 3rd a zenith reading was made with a twelve mile error and an eighty mile adjustment in their estimated position was made (Lewis 1966:92).

The following days became overcast and at least once they lost track of their position in the absence of any distinguishable swell and by being unable to observe the sun. However as they got closer to New Zealand the zenith star Phact was able to be used

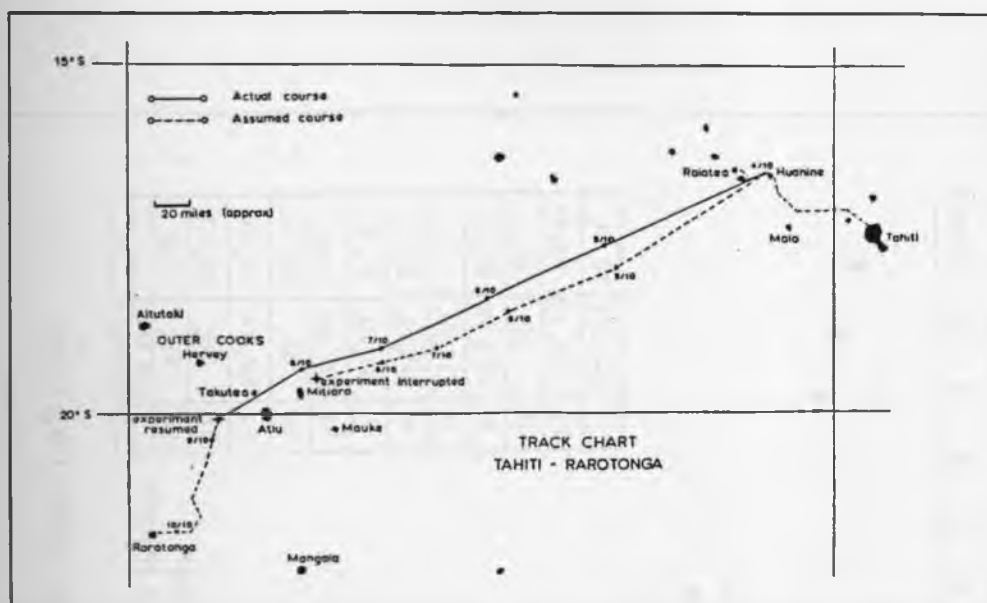


Figure 13: Daily Assumed and Actual Course from Tahiti to Rarotonga (Lewis 1966:84).

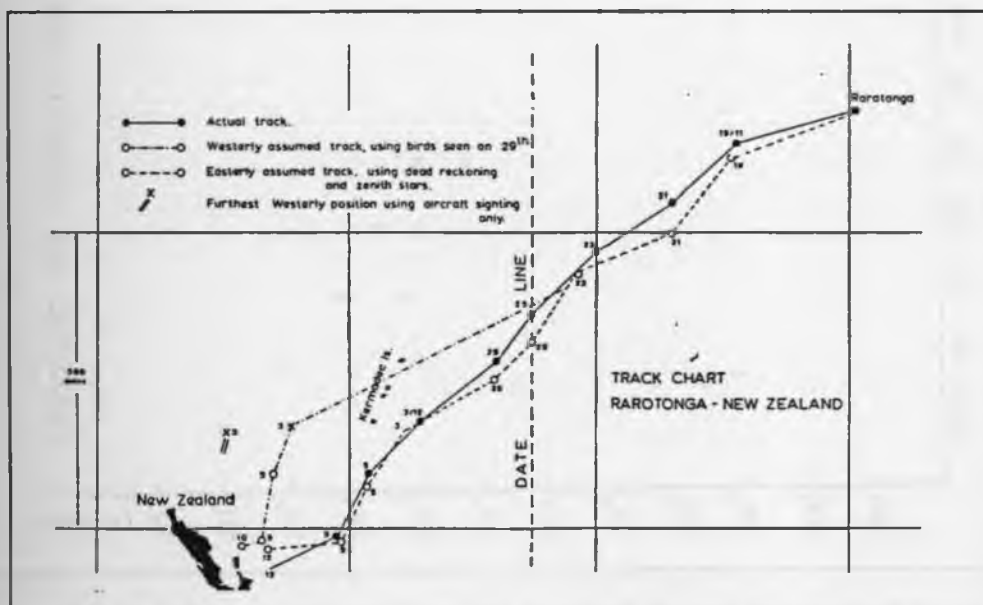


Figure 14: Daily Assumed and Actual Course from Rarotonga to New Zealand (Lewis 1966:84).

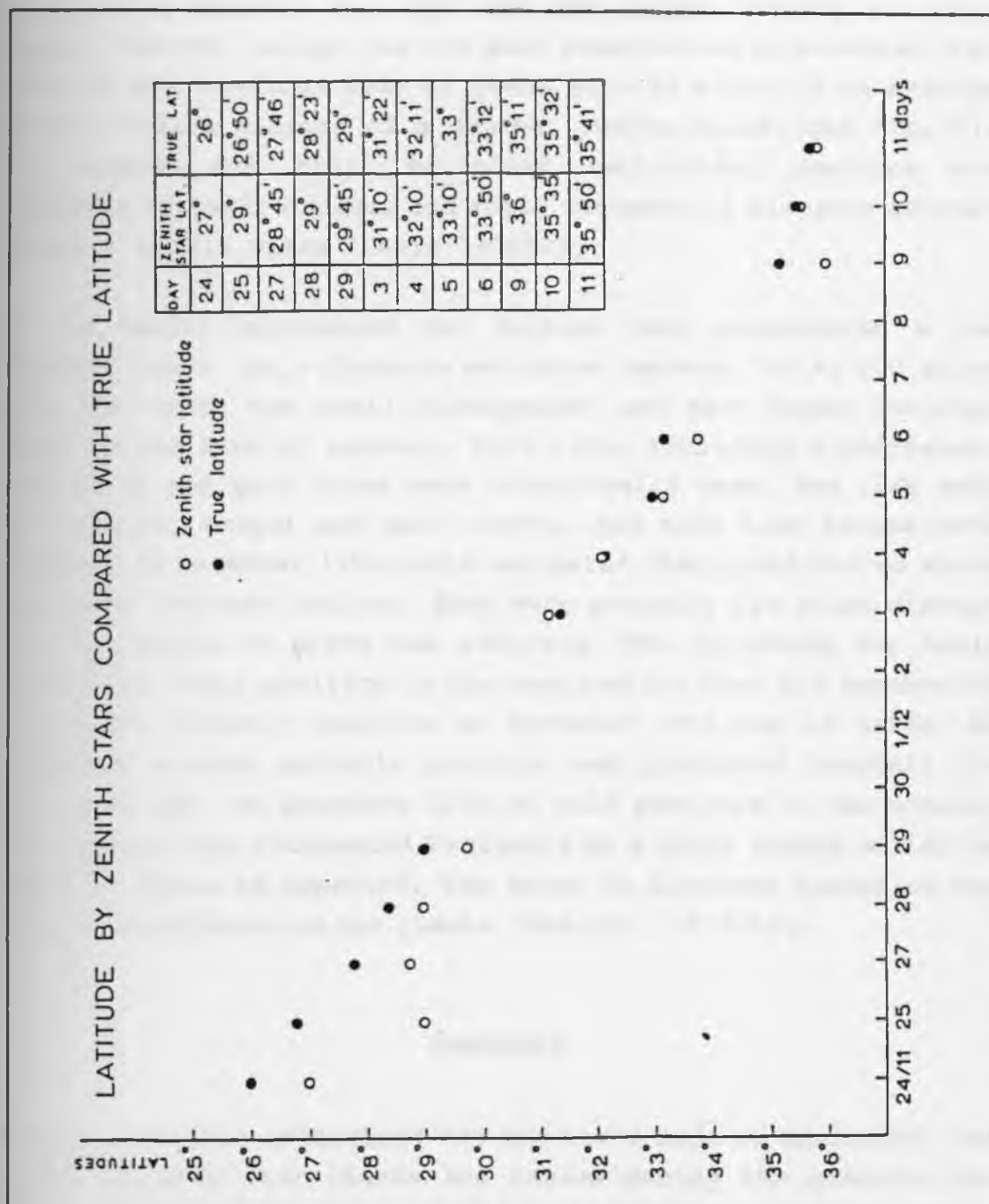


Figure 15: Latitude Estimates by Zenith Stars Compared with True Latitude Readings (Lewis 1966:91).

more directly and their latitudinal calculations began to improve significantly. Their first four readings, on this leg, had been in error by between one half and one degree (thirty to sixty miles), however, except for one poor observation on December 9th, the last six readings made by Lewis were in error by an average of just twelve minutes of a degree (twelve miles) (See Fig.15). On December 8th their estimated latitudinal position was incorrect by twelve miles, and their estimate of distance covered in error by 215 miles (Lewis 1972:93).

As the vessel approached New Zealand they encountered a low westerly swell. At a distance estimated between 150 to 200 miles from the coast the swell disappeared and they began noticing betia in the form of seaweed. Bird life, including albatrosses, rain birds and grey terns were occasionally seen. Sea life such as dolphins, carpet and mako sharks, and tuna also became more profuse. On December 11th Lewis estimated their position at about 100 miles from New Zealand. They were actually 213 miles distant but the margin of error was reducing. The following day Lewis reassessed their position in the realisation that his assumption of a more westerly position on November 29th was in error. He estimated a more probable position and predicted landfall the following day. On December 12th at half past six in the evening they sighted the Coromandel Peninsula at a point twenty-six miles south of where he expected. The error in distance travelled was only seventy-seven miles (Lewis 1966:193, 1972:93).

Summary

Sharp (1966:231) criticised the use Lewis made of Admiralty, and other European star charts and tables during the planning and execution of his voyage. This is an important point because although Lewis had used traditional methods of observation, his information and references regarding star coordinates and position of the sun were in the first instance modern in origin. The range of data available to him was probably also greater than

would have been the case for very early Polynesian navigators. Early Polynesian voyagers would have had to plot and memorise the course without any such aids.

Sharp (1966:232-233) also argued that Lewis had not replicated an ancient Polynesian voyage of discovery because he had possessed prior knowledge of his destination. He pointed out that early Polynesian voyagers would have had to firstly detect the presence of New Zealand, sail to it, discover it, and then return home with directions before navigated voyages such as that made by Lewis could have been made. He also noted, rather significantly, that the *Rehu Moana* had not seen any long-tailed or shining cuckoos during its voyage although it had taken place during the time of their migration to New Zealand.

The voyage is also problematic because although Lewis attempted to sail according to traditional methods, his yacht, mast and sails were all modern. He had therefore not answered the question about how traditional double-hulled vessels might have coped with a similar voyage in the rugged south seas.

However, it is important to remember that he was an inexperienced 'traditional navigator' who used second-hand knowledge of navigational techniques, gleaned from Micronesian and Polynesian navigators. Despite his inexperience, Lewis sailed the last 1,630 mile stretch from Rarotonga to New Zealand in four weeks and half a day within a relatively small margin of error. Furthermore he had overcome difficult conditions that had included eighteen changes in the predominant swell, sixty-four changes in wind, and sailed forty-three per cent of the time with winds that were either absent or under seven knots (Lewis 1966:93-94; 1972:93; Sharp 1966:233).

It is also pertinent that, despite the use of modern reference manuals to ascertain which stars would be useful and to determine the relative positions of both the sun and the stars, Lewis had put that information into practice according to traditional

methods of observation.

Lewis concluded that long sea voyages using astral navigation, dead reckoning, and natural phenomena were entirely feasible (Lewis 1972:3-5, 93-94). In respect of his modern test voyage he held that:

Following a sun course as we did, like using other kinds of sailing directions, implies that someone has not only found the destination, but returned home with a report of bearings and distance that would enable others to reach it too. Modern test voyages cannot, therefore, throw navigational light on original discovery. This must always be a largely accidental event, since the most an explorer could have to suggest the existence and bearing of an unknown land would be the clues afforded by drifting objects, migratory bird flight paths, and the like (1972:4).

Despite the reservations expressed by Sharp, and by Lewis himself, the voyage of the *Rehu Moana* demonstrated that traditional methods allowed for the possibility of deliberately sailing beyond the narrow limits laid down by Andrew Sharp. It also set the stage for the modern renaissance of Polynesian voyaging.

CHAPTER FIVE

HOKULE'A 1976-1980

On December 8th 1985 the *Hokule'a*, a 19-metre double-hulled canoe, reached New Zealand after sixteen and a half days voyaging from Rarotonga. This voyage occurred midway through the 'Voyage of Rediscovery' from Hawai'i to Aotearoa, Tonga, Samoa, the Cooks, Tuamotus, and back again to Hawai'i, and was part of an initiative begun twenty years earlier to learn more about the colonisation of the Pacific and the construction of Polynesian voyaging canoes, and to relearn ancient ways of navigating. The venture was also a response to the writings of Andrew Sharp, and the general over-reliance on polemic argument in the debate about Polynesian navigation. It attempted to redress the paucity of empirical data on canoe performance and navigational capability (Finney 1967:141; 1994:52).

Construction

In July and August of 1966 Ben Finney and several students built a thirteen metre, replica Hawai'ian double-hulled canoe. The plans for the *Nalehia* had been based on early European drawings of King Kamehameha III's royal canoe. The hulls had a depth of three feet, a beam measurement of two feet, and were lashed together three and a half feet apart. Modern materials were used throughout the construction, the hulls being made from a fibreglass mould (See Fig.16) (Finney 1967:147-148; 1991:II:2; 1994:53).

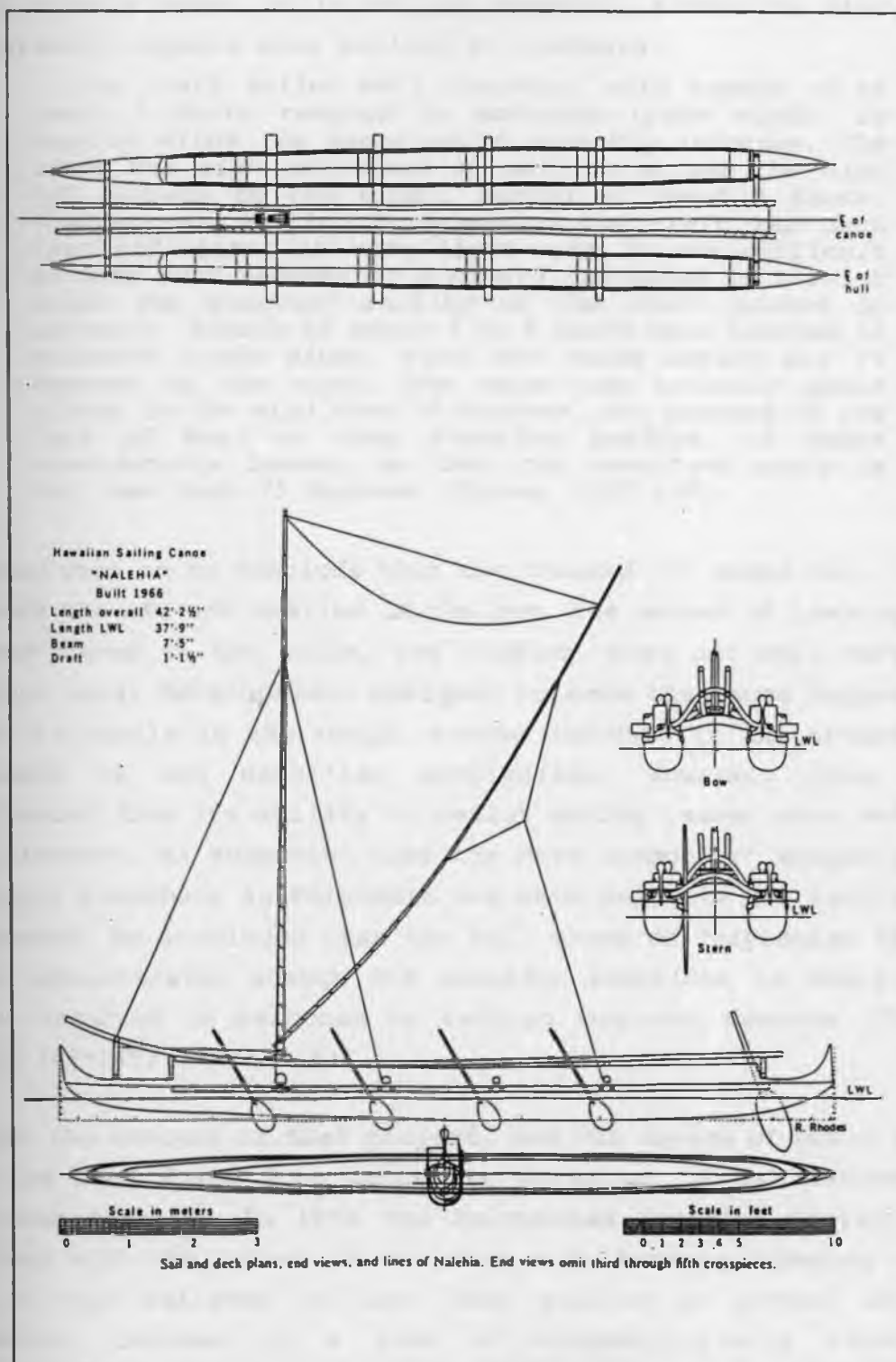


Figure 16: Nalehia (Finney 1977:1279).

Extensive trials were carried out on the Nalehia which proved to be a capable vessel while sailing downwind, across the wind, and moderately capable when sailing to windward:

...the craft sailed well downwind, with speeds of at least 8 knots reached in moderate trade winds. In heavier winds the speed would probably increase. The canoe was also efficient in sailing across the wind (90 degrees to the wind), making at least 6 knots. However, in sailing to windward the craft was much less efficient: in very light airs it was difficult to make much headway to windward, although in heavier winds the windward ability of the craft picked up markedly. Speeds of about 4 to 5 knots were reached in moderate trade winds, with the canoe making way 75 degrees to the wind. The canoe can actually point closer to the wind than 75 degrees, but because of its lack of keel or deep steering paddles, it makes considerable leeway, so that the resultant angle is not less than 75 degrees (Finney 1967:148).

Finney went on to conclude that the rounded 'U' shape hull, deep toward the aft and shallow in the bow, the manner of lashing the cross-pieces to the hulls, the rigging, mast and sail were all unique local developments designed to make the canoe rugged and easy to handle in the rough, strong currents in and around the islands of the Hawai'ian archipelago. However, this also detracted from its ability to resist making leeway when sailing to windward. He suggested that the more common 'V' shaped hull, typical elsewhere in Polynesia was more suitable for tacking to windward. He concluded that the hull shape of Polynesian canoes was sophisticated enough for specific adaptations in design, to have occurred in response to varying regional demands (Finney 1967:148-149; 1991:II:6).

After the success of that project, and the voyage of David Lewis on the *Rehu Moana* from Tahiti to Aotearoa, it was decided to proceed further. In 1973 the Polynesian Voyaging Society was formed with the intent of building a full-scale voyaging canoe of a type believed to have been sailing at around 1200AD. However, because of a lack of archaeologically recovered specimens, the design was again based on a study of European drawings from the early contact period. It was considered that

there was no time to use traditional tools and materials, so once again mostly modern materials were used in the construction. Herb Kane, an Hawai'ian artist was the principal designer along with Rudy Choy. Their plans were based on a cross-section of Polynesian canoe types with the intention of building something approximating an earlier type of canoe. Instead of 'deep-V' hulls, which were excellent for reducing leeway, they chose a 'semi-V' shape, because this was more characteristic of the canoes that had been recorded around the time of first contact with Europeans. They also avoided adopting Tongan type lateen sails, a more recent development, in favour of two masts rigged with sprit sails. Hawai'ian innovations such as high bow and stern cutwaters, and curved crossbeams were also fitted. The cutwaters enhanced the ability of the vessel to slice through the rougher waters of the Hawai'ian archipelago, and the crossbeams served to raise the deck higher above the swells (See Fig.17). The canoe was launched as the *Hokule'a* and weighed 11,400 kilograms fully loaded (Finney 1977:1278-1279; 1991:II:12-14; 1994:53-54).

The *Hokule'a* underwent sea trials with the *Nalehia* during 1975 and 1976. Both were found to be efficient craft in the sense that their slim hulls were able to cut through the sea with a minimum of pitching and rolling. The *Hokule'a* performed at a top speed of nine to ten knots, and the *Nalehia* at eight to nine knots. Neither was as fast as modern catamarans, which are generally capable of around eighteen to twenty knots, mainly because their hulls were more narrowly spaced apart. The ratios of the hull-beam to the water line length of the *Nalehia* and *Hokule'a* are 0.15 and 0.21 respectively, whereas modern catamarans have a ratio of 0.3 to 0.4 and upwards. The limited strength of wooden crosspieces and their lashings restricts the beam width because of the danger of breaking up under heavy weather. The narrow width in turn, restricts the amount of sail area that can be carried without danger of capsizing. The *Nalehia* and *Hokule'a* were able to carry nineteen and a half, and fifty square metres of sail respectively. Modern catamarans are capable of carrying

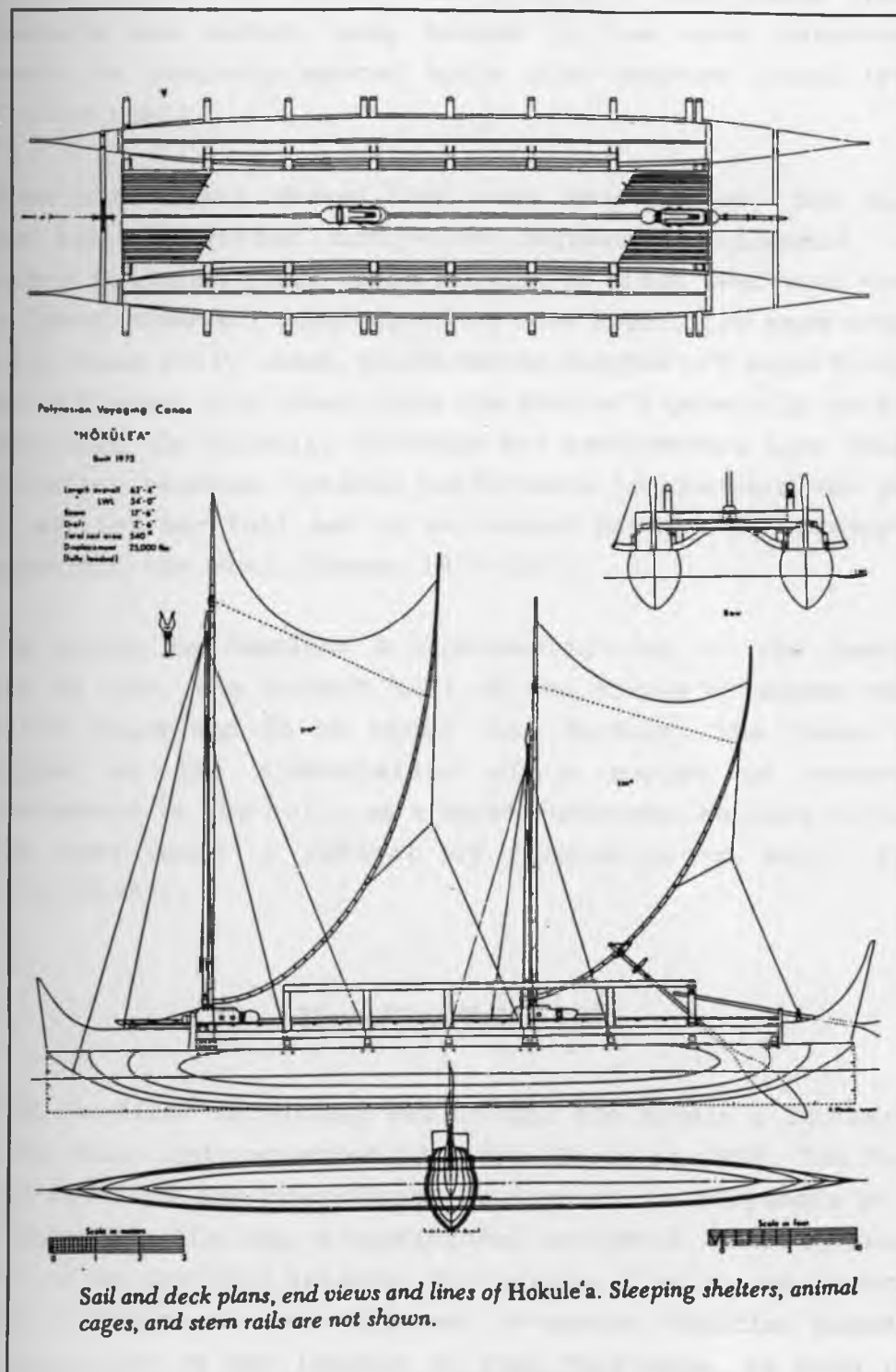


Figure 17: Hokule'a (Finney 1977:1279).

more than twice that amount, and even more when genoa jibs and spinnakers are added. Drag caused by bow wave interference between the narrowly spaced hulls also reduces speed (Finney 1977:1279-1280).

Further wind tests showed that over smooth seas, the *Nalehia* could sail to within fifty-five degrees to windward, under moderate to strong trade winds blowing at about twelve to twenty-five knots. However, when the winds were light, the seas rougher, and the canoe fully laden, performance dropped off significantly. Under different wind conditions the *Hokule'a* generally performed better than the *Nalehia*, although her performance also fell off for similar reasons. Optimum performance to windward was gained when sailing her full and by at around seventy to seventy-five degrees off the wind (Finney 1977:1281).

While trying to complete a circumnavigation of the Hawai'ian chain in 1975, the leeward hull of the *Hokule'a* became swamped and the canoe had to be towed into harbour. The Coast Guard insisted on the installation of a series of watertight compartments in the hulls as a safety measure. Failure to comply would have meant a refusal of permission to sail (Finney 1991:II:36-37).

Hawai'i to Tahiti 1976

One of the first intentions was to sail the *Hokule'a* further than the 300 mile limit asserted by Andrew Sharp in 1956. The Society could not find any traditional navigators in Polynesia so they recruited Mau Piailug, a traditional navigator, from Satawal, an atoll in the Caroline Islands, Micronesia. Piailug was instructed by David Lewis and Rodo Williams, a veteran Tahitian seaman, on the geography of the islands of East Polynesia. He also learnt about the stellar variations involved with sailing along a north to south route, as opposed to an east to west voyage, as he had been used to sailing in Micronesia. For example as one sails

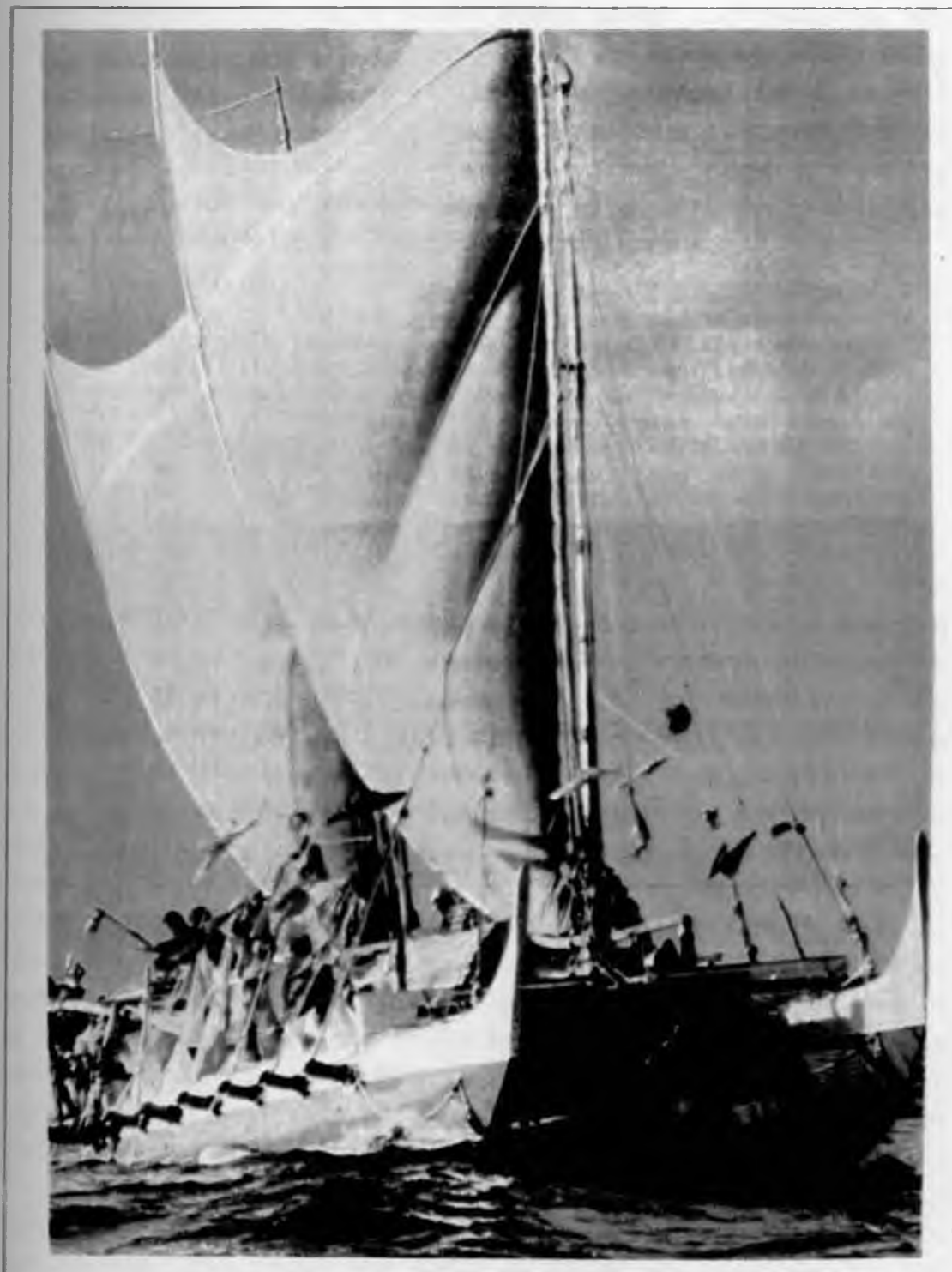


Figure 18: Hokule'a Under Sail 1976 (Science 1977).

south, Polaris, the North Star, sinks lower and lower on the horizon while the Southern Cross rises higher and higher. On May 1st 1976, under Captain Kawika Kapahulehua and with a crew of seventeen men, the *Hokule'a* sailed from Hawai'i to Tahiti in thirty-four days (Lewis 1976:512; Morse 1984:2; Finney 1991:II:39; 1994:54). Before departing Piailug addressed the crew:

I wish to speak to the crew, how they should conduct themselves in the deep sea...Before we sail, we must throw away all things that worry us. On the ocean all the food, all the water, is under the control of the captain...everything the captain says to do, we follow. Only the captain tells us when to change course. When you are on the ocean you cannot see any islands. Only the things we bring with us help us to survive. We act together. That is all I have to say. Remember, all of you, and we will see that place we are going to (Lewis 1976:516).

Finney had projected an easterly course against the prevailing northeast and southeast trade winds, and equatorial currents which are capable of moving a vessel up to forty-five miles westward each day (See Fig.19). The course was divided into three segments: the first was the northeast trade wind zone, where it was intended to sail southeast across the prevailing winds; the second lay in the intertropical convergence zone or doldrums, where southward progress would be slowed by shifting bands of calms and light variable winds, and by a strong equatorial counter-current which would push the canoe eastward; the third section was the southeast trade wind zone where the canoe would be forced slightly west of south by the winds and currents. The priority during the first two stages would be to gain sufficient easting to allow a good run to Tahiti during the final stage (Finney 1977:1281-1282, 1991:II:37-38; Crouch et al 1991:VII:1-2).

The voyage was made without a compass, sextant or other instruments. The canoe was held as close as possible to the prevailing winds. Course and position were estimated by dead reckoning and observation of horizon, polar and zenith stars. Latitude was estimated by star observation which Mau confirmed

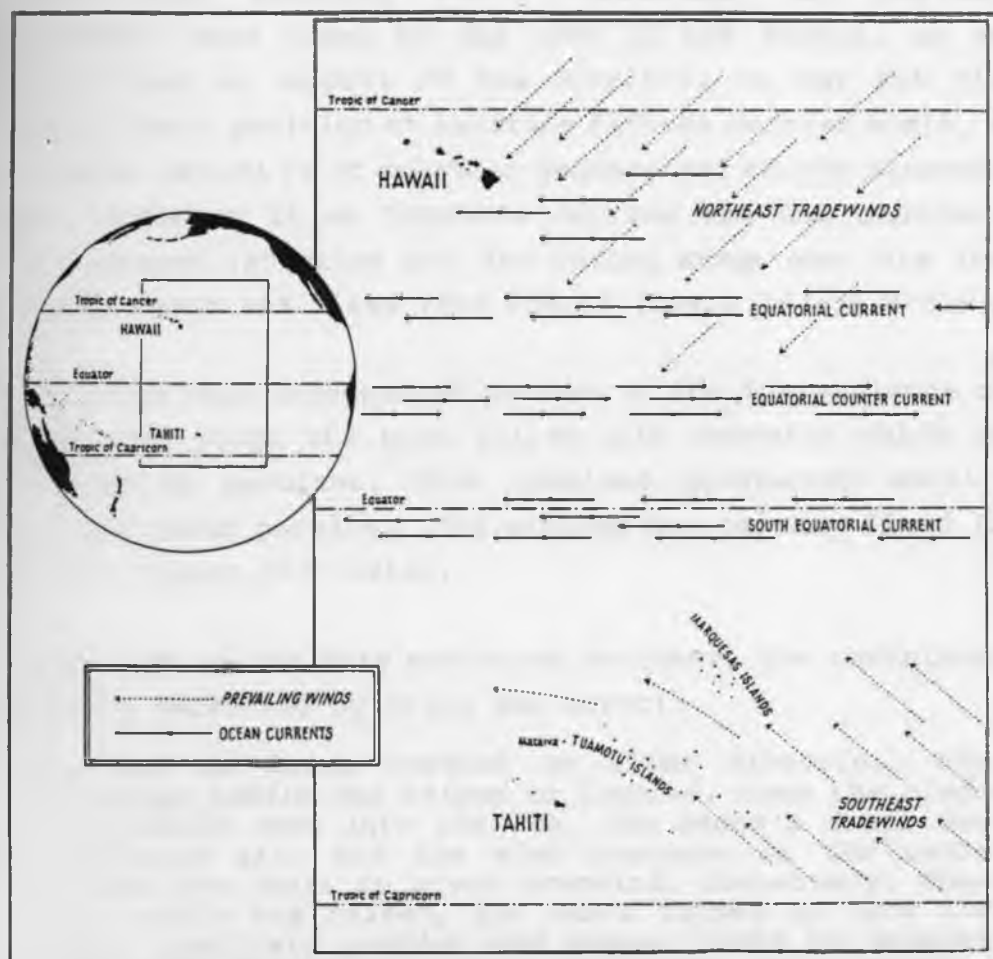


Figure 19: General Pattern of Winds and Currents between Hawai'i and Tahiti (Froiseth et al 1984:96).

on their first night out of Hawai'i by judging the altitude of Polaris, the North Star, with the span of his thumb and forefinger loosely extended at arms length. He estimated their position at one and a half 'ey-ass'; an ey-ass is about fifteen degrees, they were twenty-one degrees north. Lewis estimated their speed by counting off seconds as they passed waves. Five seconds equalled five knots. Reportedly, Piailug merely looked at the water sweeping past. Positional and performance measurements were taken by the crew of the *Meotai*, an escort yacht sailing in support of the *Hokule'a*. On May 8th Piailug estimated their position at latitude fifteen degrees north, while David Lewis gauged it at fourteen degrees and thirty minutes. The *Meotai* confirmed it at fourteen degrees and six minutes. The canoe averaged 120 miles per day during stage one, the longest run being about 145 miles (See Fig.20)(Lewis 1976:516-519).

Difficulties were encountered because of the inexperience of the crew. At one stage the bows filled with seawater which caused some steering problems. This remained undetected until they passed the tenth parallel. The problem was quickly fixed (Lewis 1976:522; Finney 1977:1282).

The main task of the duty watch was to steer, the technique they used being perfected by trial and error:

Instead of being rotated to alter direction, the steering paddle was raised or lowered. When the blade was pushed down into the sea, the canoe's draft was increased aft, and the wind pressure on the sails caused the craft to pivot downwind. Conversely, when the paddle was raised, the canoe turned up into the wind. Auxiliary paddles and sweeps could be brought into play for sharp changes of course, as in tacking (Lewis 1976:523).

By the second week Piailug had analyzed and identified five main swells coming variously from the north, northeast, east-northeast, southeast, and south. Not all were apparent at the same time and the most noticeable was that from the northeast which struck the port beam every half minute. Progress was a slow forty miles per day through the doldrums, although the current

pushed them sufficiently eastward. Fresh food had been carried and used on the first few days. The bulk of the provisions consisted of hundreds of coconuts, sun-dried fish, dried sweet potatoes and bananas, and sour fermented taro poi. One day's fishing netted them over one hundred pounds of tuna and bonito. Rain squalls added nearly thirty gallons of water. A dog, pig and chicken were carried on the canoe as one object of the voyage was to find out how animals may have fared on voyages of deliberate colonisation. Sprouting coconuts, breadfruit, sweet potatoes, sugarcane roots and other species of plants were also carried. It had been the original intention to eat only traditional foods throughout the trip but after about two weeks some of the crew requested supplies of cornbeef, flour and rice from the *Meotai* (Lewis 1976:513-516, 519-524).

The pressure of the voyage and the cramming together of seventeen men on a nine foot by forty foot space began to tell. The crew divided into two camps. There were other discipline problems such as crew not taking their turn on watch. Tempers began to fray and towards the end of the voyage there was at least one fight (Lewis 1976:527-528, 536).

During the third stage the winds were often more southerly which forced them in a more southwesterly direction toward the Cooks. After crossing latitude eight degrees south the winds backed toward the east allowing a more southerly course to be steered for Tahiti. From May 29th to 30th *Hokule'a* made about 160 miles during one twenty-four hour period (Finney 1977:1823). During the day they received frequent visits from petrels and shearwaters. One day they were also followed by thirteen brown boobies which they estimated were about 700 miles from land. Piailug commented that he had never witnessed them this far from land before (Lewis 1976:526-527). After four weeks at sea Piailug estimated they were 180 miles north of the Tuamotus and 350 miles from Tahiti. Toward evening on May 31st the swell from the southeast abruptly stopped. This meant they had sailed into the shelter of an island chain. They then observed two terns which usually never fly more

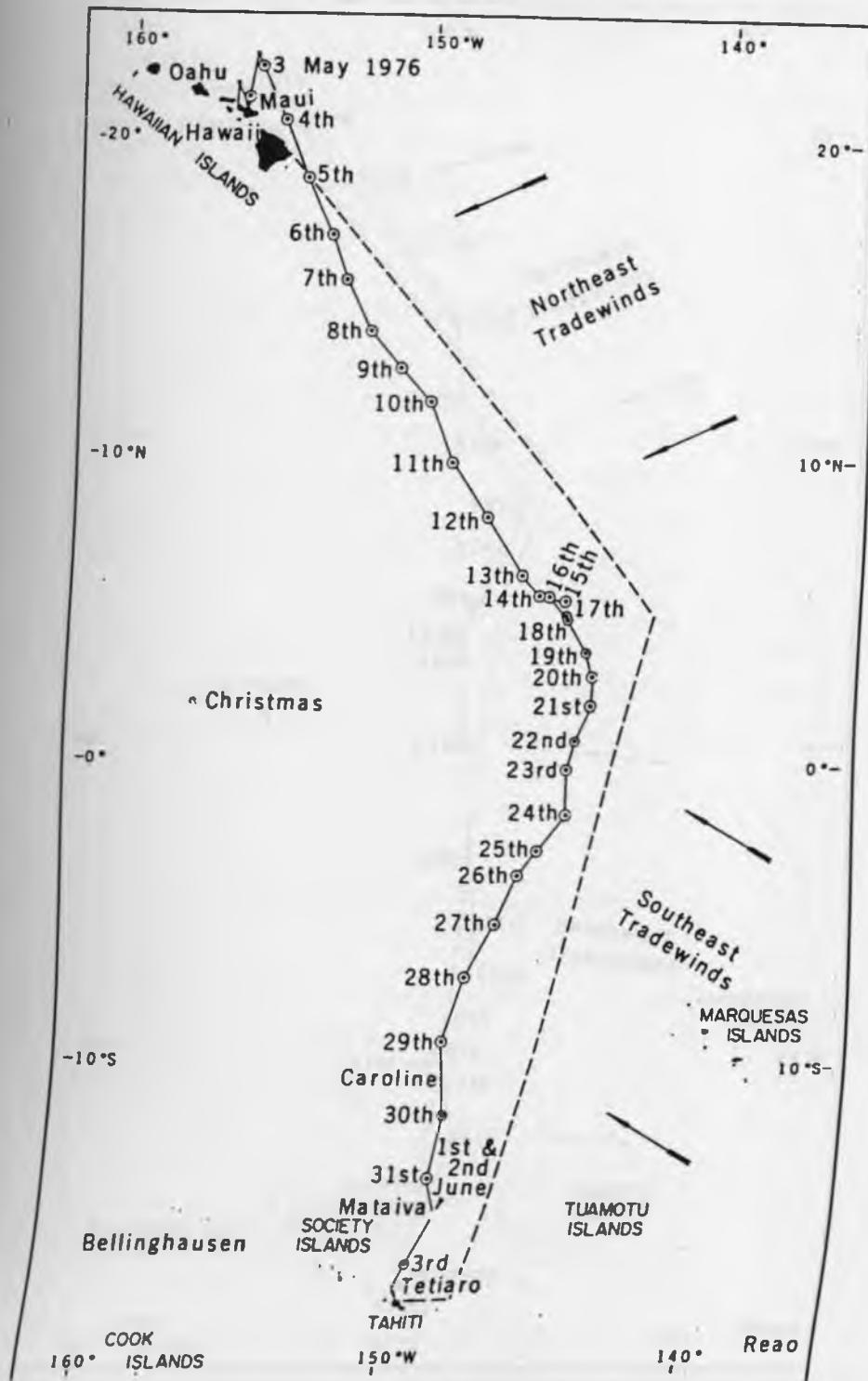


Figure 20: Projected and Actual Course, Hawai'i to Tahiti 1976 (Finney 1977:1278).

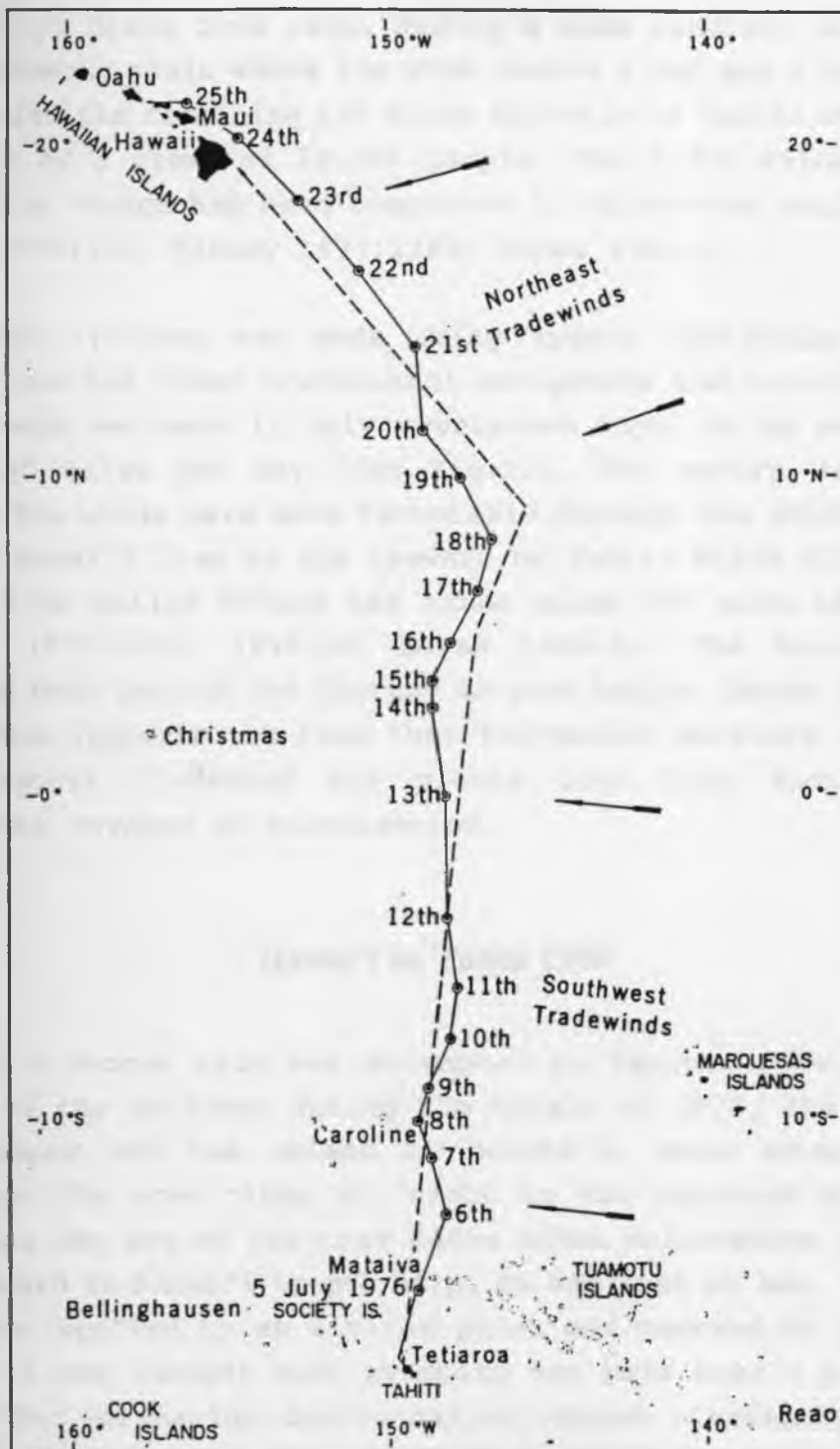


Figure 21: Projected and Actual Course, Tahiti to Hawai'i 1976 (Finney 1977:1278).

than thirty miles from land. *Hokule'a* made landfall at Mataiva in the Tuamotu chain where the crew rested a day and a half. They then sailed the remaining 170 miles directly to Tahiti where they were met by a crowd of 25,000 people. The 5,370 kilometre, or 3,060 mile voyage had been completed in thirty-two sailing days (Lewis 1976:530; Finney 1977:1283; Morse 1984:2).

The return journey was made using modern navigation because Piailug and the other traditional navigators had returned home. This voyage was made in only twenty-two days, at an average of about 140 miles per day (See Fig.21). The return was faster because the winds were more favourable through the doldrums, and because Hawai'i lies to the leeward of Tahiti which allowed the canoe to be sailed before the trade winds for much of the way (Finney 1977:1283, 1994:54; Morse 1984:2). The four animals survived both legs of the journey in good health (Mower 1984:137-138). This supports the idea that Polynesian mariners were able to transport livestock and plants over long distances on deliberate voyages of colonisation.

Hawai'i to Tahiti 1980

In 1978 a second trip was attempted to Tahiti. However, in a repeat of the accident during the trials of 1975, the *Hokule'a* got swamped off the island of Moloka'i, soon after leaving Honolulu. The crew clung all night to the capsized hulls. The following day one of the crew Eddie Aikau volunteered to paddle a surfboard to Lanai'i to get help. He was lost at sea. The canoe was later spotted by an airline pilot and rescued by the Coast Guard. It was thought that swamping may have been a particular danger for Polynesian double-hulled canoes. Certainly as each hull is emptied of water, the increased buoyancy depresses the other into the water (Finney 1977:1281; Morse 1984:2; Kyselka 1987:17).

In 1980 a third voyage was mounted, the *Hokule'a* being navigated

by Nainoa Thompson, who had received intensive instruction from Mau Piailug, and assistance from Will Kyselka of the Bishop Museum Planetarium, and who was also partly self-taught (Morse 1984:7; Finney 1994:55). Thompson developed his own thirty-two star sidereal compass similar to the Micronesia type used by Mau Piailug. His compass not only included the names, rising and setting points of selected stars but was also divided into thirty-two, eleven point five degree margins of bearing. These sectors he called 'houses'. Each 'house' was named for its particular bearing. The advantage of this system is that when sailing north to south the houses act as a contiguous framework for reorienting the navigator as the stars appeared to move around him (See Fig.22). He also memorised the declinations, risings, and settings of 110 stars, which apparently is more than Mau himself had remembered. However Mau was used to sailing east to west where star references are very consistent. Navigating on a north to south axis means there is a greater variation in the number of relevant reference stars rising and setting on the horizon (Kyselka 1987:38-44; 59-66; Finney 1991:II:11-12).

The principles of his system are simple but effective:

Nainoa visualizes Hokule'a as a big bird flying with wings outstretched. This visualization, plus the use of repeating names for his compass houses, helps him use stars located in any direction for course setting and steering. When, for example, Nainoa sets the bow of the canoe (the prow pieces of which are still known as manu in Hawai'ian) towards southeast Manu he knows that the stern of the canoe points back to manu in the opposite, northwest quadrant, and the wings (i.e. 90 degrees to port and starboard) point to manu houses in the adjacent northwest and southwest quadrants. As he also knows what stars would be rising or setting in these four houses at the time he is sailing, this gives him four choices for course setting and steering, not just one (Finney 1991:II:12-13).

It was planned to sail this voyage during March and April because the wind and current patterns were at their most favourable. This was also the optimum time for astronomical navigation because of the number of bright stars that appear during the early evening (Kyselka 1984:112).

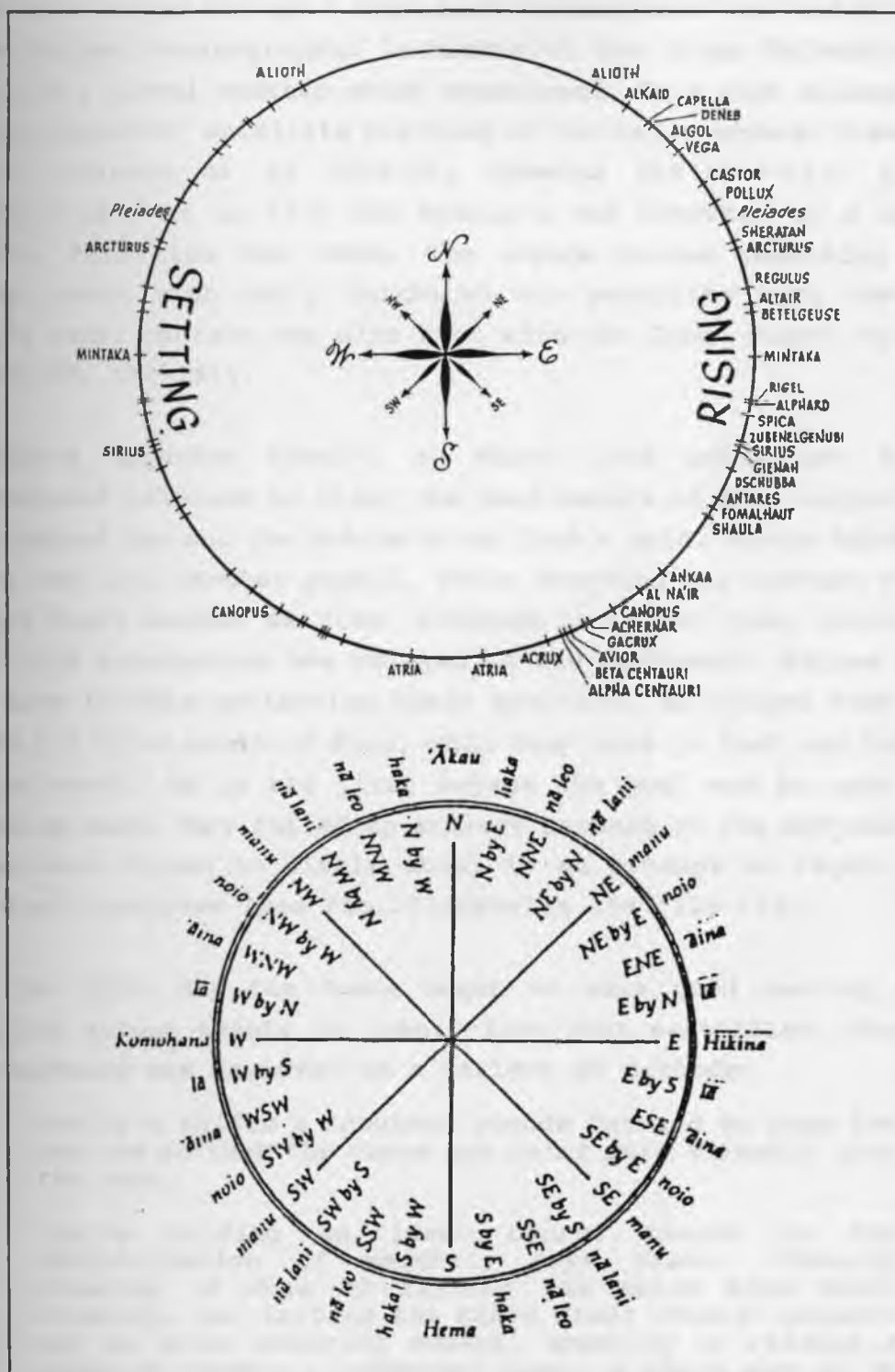


Figure 22: Nainoa Thompson's Compass Showing Star Names and 'Houses' (Kyselka 1987:39)(Finney 1986:54).

For this second voyage a satellite transmitter was installed by the Scripps Oceanographic Institute of San Diego University as part of a global weather study experiment. This also allowed for 'non-intrusive' satellite tracking of the canoe several times per day (Froiseth et al 1984:96; Kyselka 1987:156-157; Finney 1991:II:22). As in 1976 the *Hokule'a* was escorted by a modern yacht, this time the *Ishka*. The voyage became something of a media event with daily talkbacks via satellite with Hawai'i. Daily radio contact was also kept with the Coast Guard (Kyselka 1987:109, 137-141).

Hokule'a departed Hawai'i on March 15th using her forty-horsepower outboard to clear the calm waters of Hilo harbour. On her second day out the *Hokule'a* ran into a gale. On the third day they ran into another squall. Their position was checked by the Coast Guard weather service, although it is not clear whether or not this information was relayed to the navigator. Nainoa began to have trouble estimating their position. He gauged that they were 175 miles south of Hilo, when they were in fact one hundred miles south. As in the first voyage the goal was to make good easting which they failed to achieve because of the bad weather. They were forced to circle about in an attempt to regain some easterly progress (See Fig.23)(Kyselka 1987:125-132).

By the fifth day the canoe began to make good easting while sailing across twenty to twenty-five knot easterlies. Progress to windward was achieved by a variety of methods:

Hokule'a shifts a thousand pounds forward to keep the bow low so that the canoe can point more directly into the wind.

'We're holding an ideal course thanks to the redistribution of weight', says Steve. 'Usually steering is done by filling the sails with wind, trimming, and letting the canoe steer itself. Another way is using steering sweeps, lowering or raising a sweep to create a temporary keel. A third way is by shifting the weight as we're doing today (Kyselka 1987:133).

Nainoa learnt much from Mau about reading swell patterns although

Mau's greater experience was clear. Whereas he could readily identify five swells, Nainoa was competently reading three:

The biggest and most consistent is NE Manu. It's running over and disguising the Hikina [East]. The SE Manu swell is also there (Kyselka 1987:135).

He also learnt much about wind and cloud patterns as Mau instructed him:

If the rain cloud is black, the wind is not strong. If the cloud is brown, the wind is probably strong. If the cloud is high, there's not much wind but maybe a lot of rain. If its low, probably lots of wind. What you do is to sail up to it. The last clue is the color of the line at the surface of the water beneath the cloud. If it is black you know it is a real strong wind. If it's the same color as the ocean near you then it is not a strong wind. If the water is bumpy inside then you know there's a strong wind (Kyselka 1987:145).

Nainoa marvelled at the extent of Piailug's instinct and knowledge:

...Mau can see change in the wind by the 'road' of the clouds: 'Clouds rise out of the horizon. Mau can tell a wind change long before it happens. I have yet to see that road.

...Mau knows direction like he knows the back of his hand. He knows waves like he knows an old friend. The waves show him the way no matter how they're covered up. Mau just looks at the ocean and he sees direction. He can't explain how he does it. He's an artist, a master. I can appreciate his art without being able to do it (Kyselka 1987:145-146).

On the seventh day Nainoa again had difficulty with the navigation. Because of the weather, many of the stars he wanted to use were only visible for brief periods. The swells were also confusing to read. He referred to them as 'bust up' swells. He estimated their position at thirteen and one half degrees latitude north, 540 miles south of Honolulu, an error of eighty miles (Kyselka 1987:138-139).

The constant heading against the wind and swell of the first week and a half had taken its toll on the *Hokule'a*. One of the booms on a sail cracked, then broke and was repaired three times. A

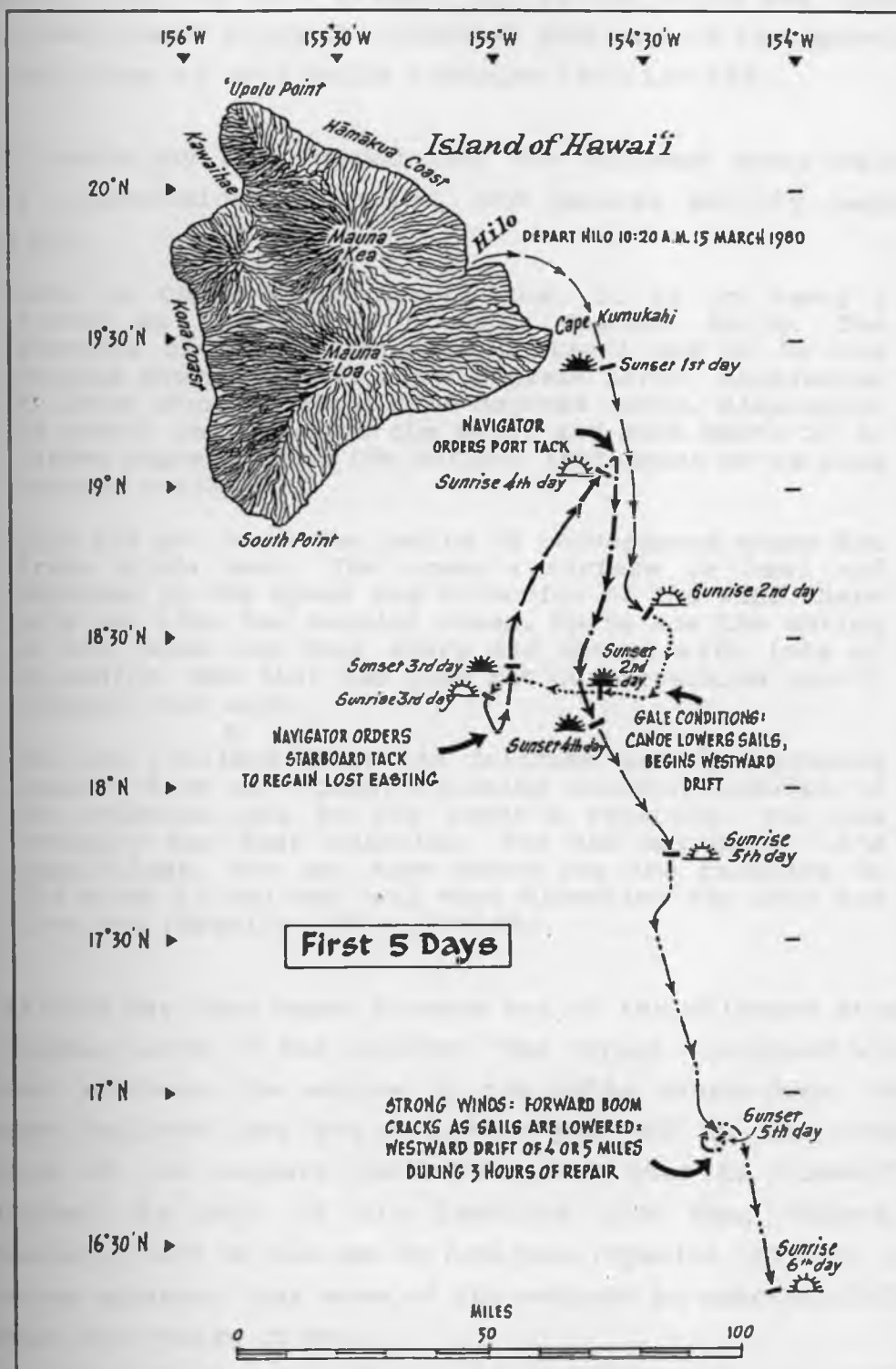


Figure 23: The First Five Days out of Hawai'i (Kyselka 1987:132).

steering sweep was also broken. One of the sails was torn and cracks had opened along the bulkhead portions of the gunwale on the port sides of both hulls (Kyselka 1987:143-144).

On the tenth day they headed into the doldrums where Nainoa's memory, astronomical expertise, and general ability began to stand out:

Crux is three times higher than it is in Hawai'i giving as a latitude of nine degrees north. The distance of Menkent to Beta Centauri and on to the horizon shows us about eight degrees north. Miaplacius to Avior shows us about nine degrees north. Miaplacius is twenty degrees from the pole, and here where it is eleven degrees above the horizon that means we're nine degrees north.

This had got to be the region of convergence where the trade winds meet. The ocean's surface is bent and deformed by the speed and direction of the wind. Here it's not like the regular ocean. Up to now the motion of the canoe has been sharp and abrupt with lots of splashing. Now that has gone but our direction hasn't changed that much.

Mau and I talked about the doldrums and the spinning clouds. Warm air rises, spinning counterclockwise in the doldrums due to the earth's rotation. You can actually see that spinning. For the navigator it's significant. You can know where you are relative to the winds if you can tell what direction the lows are from you (Kyselka 1987: 147-149).

By the 18th day they began to move out of the doldrums at about two degrees north of the equator. The voyage continued without incident although the engine on the *Ishka* broke down. Nainoa Thompson believed Mau was a little put off by the constant presence of the support yacht. He felt that he himself was unaffected. As part of his learning from Mau, Nainoa was increasingly left on his own to navigate (Kyselka 151-165, 173). It became apparent that some of the methods he adopted differed somewhat from those of Mau:

I look at Mau's navigational statements. Lots of what he says doesn't make mathematical sense to me. But it works for him and had enabled his survival.

Mathematics misses when we try to understand what he

does.

His system works for him without a doubt...My system makes sense to me. Whether it works or not we'll soon see.

Mau determines latitude by using the Big Dipper, Little Dipper, and the Southern Cross. He doesn't care about zenith stars. He considers that playing around. The concept of zenith star has no meaning for him (Kyselka 1980:158-159, 173).

On the twenty-fifth day at sea the winds were very light, the expected southeast trades not arriving. The south equatorial current pushed them southwest but without the winds their forward progress was slight. There was some risk that they might go past Tahiti. The weather also became continually warmer causing an increase in the consumption of water. Concern rose as their reserves fell. They also only made seventy-five miles progress on days twenty-six and twenty-seven. However, they did begin to observe land roosting birds such as black noddy terns and occasional leaves floating on the sea. Land was near (Kyselka 1987:182-184, 188).

On the twenty-eighth day Nainoa calculated their position and predicted landfall:

The pair star in the Obtuse Triangle gives our latitude as 11 degrees south. Using the 15 degrees star and Dubhe, we get 12 degrees. The 23 degree star and Merak give us 12 degrees. Phecda gives 12 degrees with the 22 degree hand span. Alioth measures 11.5 degrees using the hand span. The 20 degree star gives 12 degrees with my four fingers open. Measuring with Kocab, the 18 degree star and the 24 degree star all average out to 11 degrees south.

...First land in three or four days. Or if we see no land at all then, Tahiti in six days (Kyselka 1987:189).

On the twenty-ninth there was a dramatic increase in the number of land birds seen. They also noted that the southeast swell had stopped probably because it was being blocked off by the Tuamotu chain of islands. At sunset on the thirtieth day they observed

a land bird flying in exactly the same direction as the *Hokule'a* which probably meant that land was directly ahead. They followed it into the dusk (Kyselka 1987:194).

The problem now was to detect land. At sunrise on the thirty-first day they hove-to waiting for land birds to appear. Mid-morning they sighted the island of Tikehau just east of Mataiva where *Hokule'a* landed in 1976. They sailed between the islands and two days later landed in Tahiti (Kyselka 1987:196-202).

The *Hokule'a* departed Tahiti in early May. A new boom replaced the one broken during the voyage to Tahiti and metal plates had been bolted onto some of the crossbeams whose laminations had begun separating because of stress (Kyselka 1987:205-206).

On any voyage the first night out is an important time for astronomical orientation:

*The Southern Cross is now in the sky behind us. Each night for the next three or four weeks we'll see it slightly lower, and by the time we reach Hawai'i it will be at the horizon. It will be ten days yet before we'll see the North Star. During the next few hours the tiny island of Teti'aroa will be moving along our star compass from Akau to Hema as we pass close to it (Kyselka 1987:206).*¹³

The morning sunrise is another crucial moment:

It is the time for judging the sea and swells relative to the positions of the stars, a time for reading of the weather for the day (Kyselka 1987:206).

By June 1st they had travelled for ten days in cloudy conditions. Nainoa estimated that they had gone 260 miles without being able to check their position astronomically. Nevertheless, he had been able to utilise the moon and swells, although variable winds tended to confuse them. He was also able to navigate according to the position of very high, slow moving, far off cloud whose bearings changed little in relation to the motion of the canoe.

¹³ The notes regarding the return voyage to Hawai'i are from Nainoa Thompson's diary.

That night he calculated their position at thirteen point five degrees latitude north, but was bothered by the sighting of a dove the previous day, apparently far away from land (Kyselka 1987:208-211).

On the night of June 2nd he was able to sight enough stars to work out that they were at fourteen degrees latitude north. On this day land birds were conspicuously absent. They had originally intended to run east and upwind of Hawai'i, because turning back and running before the northeast trades would give them a 1,500 mile target, in the form of the greater Hawai'ian archipelago, to aim at. The question was whether or not they were in such a position to begin their run. Bearing too far to the west and south would have meant running into hundreds of miles of open ocean (Kyselka 1987:211-214).

Nainoa made another calculation about where land might lie:

We're able to use the land stars of the Southern Cross (Hawai'ians know it as Nawa), Atria in the Southern Triangle, and the two brilliant stars, Alpha and Beta Centauri. Hokupa'a, the North Star, is gaining altitude each night, and from this array of stars I judge South Point to be 180 miles to the north and 220 miles west of us (Kyselka 1987:215).

Then during the morning of June 3rd they sighted a group of birds feeding at sea which included several white tropic birds and a dove, a good sign of nearby land. During the night the Southern Cross was observed very near the horizon. Nainoa's experience of observing it from various locations in Kaua'i, Kona, and South Point told him that they were in the latitude of Hawai'i (Kyselka 1987:215-219). His new found powers of concentration and observation also came to the fore when sighting land:

The sun is nearing the horizon and a peculiar image is forming. I don't know why. The cloud bank turns gray, almost black, like rain. Around the cloud bank, though, is a consistent orange color. It's a strange sight.

Something is different about the setting sun. Its something we haven't seen before. So we alter our course slightly and head directly into the sun...

The crew is silent. I think they have a feeling, too, that land lies just below the sun...

I walk to the bow of the canoe for I know the island is there. I don't know how I know...

Suddenly a particular cloud begins separating. It has the same quality as other clouds in terms of whiteness. But this one is not travelling. It's stationary, and it opens up to reveal a long, gentle slope with a slight bump cinder cone on the side of Mauna Kea! (Kyselka 1987:220-221).

A second successful voyage had been completed and a new navigator had finished his apprenticeship.

Summary

On the first voyage Piailug had demonstrated that although his methods differed somewhat from Polynesian methods, and although he was sailing thousands of miles away from his home in foreign waters, the systems employed were variations on common navigational principles. He had successfully proved the versatility of traditional methods of navigation:

Since we started from the island of Maui, some 500 miles to leeward with respect to the trades of the meridian of Tahiti, this crossing demonstrated how a double canoe can reach across and moderately into the trades in long crossings. Piailug's naked-eye observations of the sun, stars and moon, the ocean swells, and when nearing the Tuamotus, the appearance of land birds fishing out to sea, guided Hokule'a to her intended landfall in the western Tuamotus, and then to Tahiti (Finney 1994:54).

In respect of what had been learned on the 1976 voyages Finney, in reply to Sharp's contention that Polynesian canoes could not sail to windward, concluded that double-hulled Polynesian canoes were capable of sailing over long distances and under varying conditions at seventy-five degrees from the wind as an optimum, and even conservative angle, although under ideal conditions they were easily capable of sailing much closer. He noted that this

was closer in performance to older square-rigged European ships than to modern racing yachts, although adequate enough for settling all the islands of the Polynesia. Sailing to windward requires tacking in a zigzag pattern. A modern yacht can do this at forty-five degrees to the wind and would be required to cover 140 miles for every one hundred miles direct progress. A Polynesian canoe sailing at seventy-five degrees to the wind would travel 390 miles to make the same one hundred miles progress. Certainly the feat of sailing the long traverse north to south, and back again between Hawai'i and Tahiti, against the trade winds, dismisses much of the doubt about the sailing ability of Polynesian double-hulled canoes (Finney 1977:1283; Kane 1984:9; Sneider and Kyselka 1986:46).

Finney also proposed, in reference to inter-archipelago voyaging beyond the limits suggested by Sharp, that although two-way voyaging was entirely feasible it was unlikely that this was ever extensive because of the demands of building suitable craft, the need to maintain high standards of navigational skill, and the organisational demands required to continually launch such voyages over long distances (1977:1284).

This voyage also suffered from a lack of discipline and personal conflict. Young (1984:145-146) noted six psychological effects of long distance sailing: the first is the limitation on space, the second is the weather where people are subject to long periods of cold and wet, or alternatively long periods of blistering heat; the third effect is the need to change eating and drinking habits in order to conserve supplies. These changes cause irritability; the fourth relates to being tolerant of other personalities and working together; the fifth is boredom through repetition; and the sixth is danger, which can cause nausea, vomiting, nightmares, skin rashes, and nervous shaking. In combination these pressures can cause disagreement, disharmony and violence. Ultimately they can cause a voyage to fail. Unity and discipline are crucial. Piailug's words at the beginning of the 1976 voyage were more important than realised.

On each day of the 1980 voyage Nainoa reported his estimates of the direction, and distances to the Marquesas, Tuamotus, Societies, Cooks, and Hawai'i, to the crew of the *Ishka*. He made his calculations by gauging the declination of stars and their altitudes at particular latitudes. He also took into account how the patterns of wind and current influenced the relative position of the canoe. The five distances were plotted, and the centre point used as a positional estimate for comparison, with their position as measured by the ARGOS satellite. A comparison of the presumed and actual courses for the 1980 leg shows them to be generally within one hundred miles of each other (See Fig.24). The courses for the return are even closer, being not more than sixty miles apart (See Fig.25). Kyselka suggests this may have been due to Nainoa's increased experience. However, it is also probably due to the fact that the return is easier to make because of the angle of the winds. Whatever the reason, the accuracy is impressive (Kyselka 1987:225-229).

Through the practice, trial and error of the traditional methods taught to him by Mau Piailug, and some new methods with which he experimented, Nainoa Thompson developed his own navigational framework, in the hope that it might in some way shed light on methods that had long since been lost. He began using a system of dead reckoning based on plotting an initial reference course line, which he memorised before departing on a voyage. During the voyage he would make positional estimates in terms of where he thought the canoe was situated in relation to the plotted reference course. These estimates were based on observations of horizon stars, the sun, the moon, swell and wind patterns, and calculations of speed. He found that this simplified dead reckoning in the sense that:

Instead of keeping every twist and turn of the canoe in mind over the entire voyage, each day the navigator only needs to take his estimate of the canoes offset and add or subtract it from the previous days offset to come up with a new estimate of the canoe's position in relation to the course line (Finney 1991:III:15).

In addition to this, he also developed an alternative method to

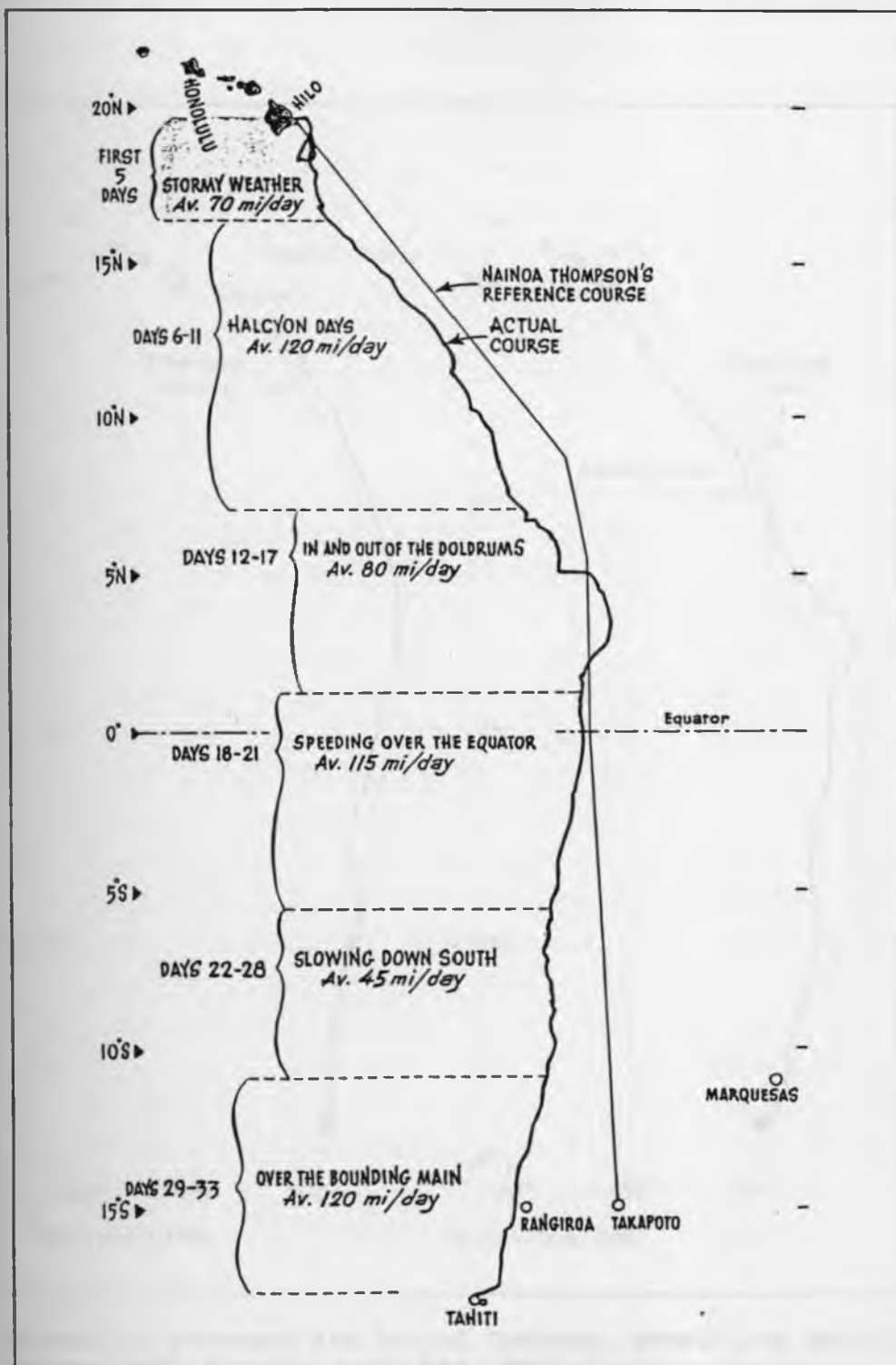


Figure 24: Projected and Actual Course, Hawai'i to Tahiti 1980 (Kyselka 1987:124).

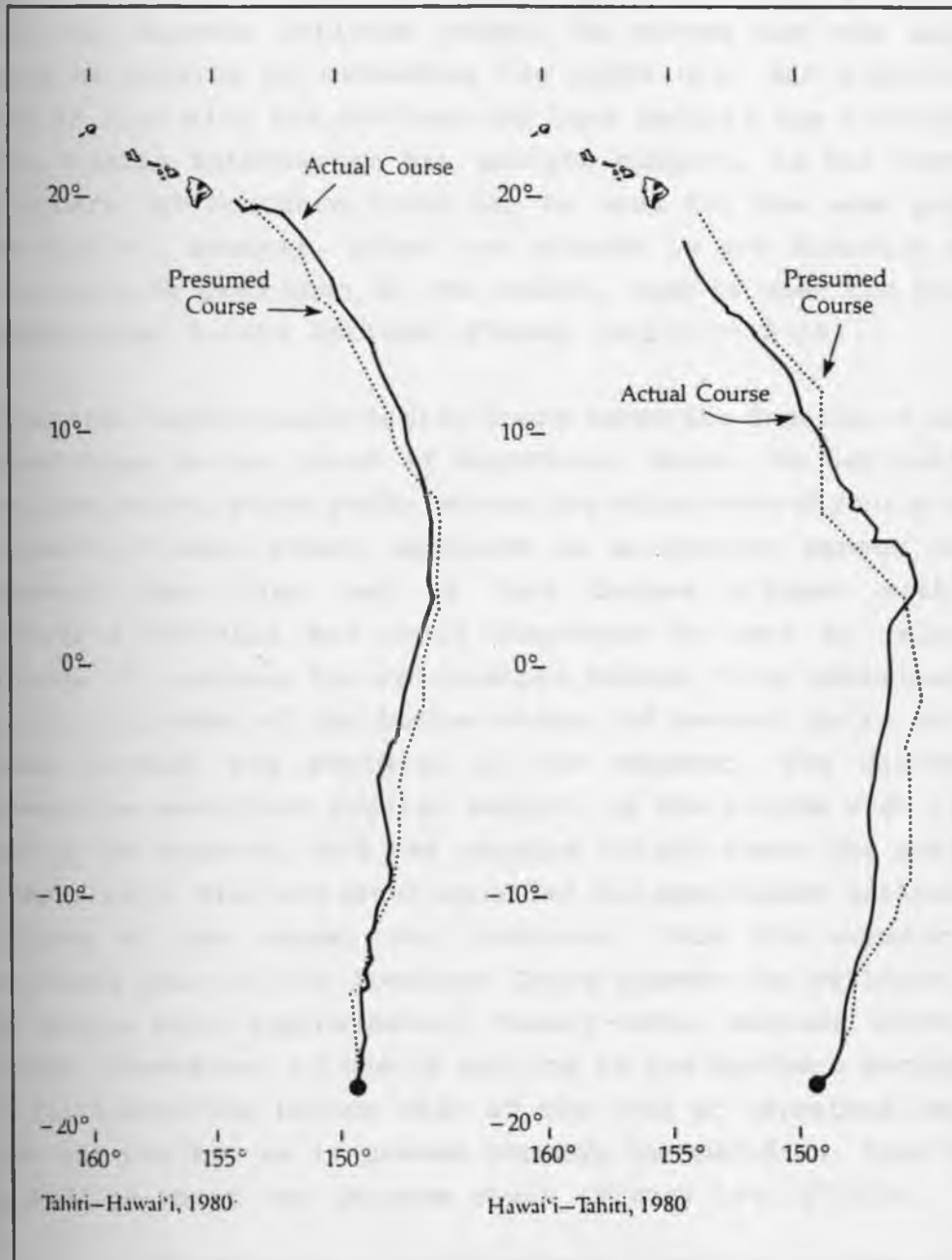


Figure 25: Presumed and Actual Courses, Hawai'i to Tahiti Return 1980 (Kyselka 1987:226, 228).

that used by Lewis, to measure latitude. He realised that the angular altitude of Polaris above the horizon was virtually equal to the latitude of the observer. Thus if Polaris appears ten degrees above the horizon then the observer must be situated at about ten degrees latitude north. He worked out the angular height of Polaris by extending his right arm, and placing his thumb in line with the horizon and then gauging the altitude by where Polaris intersected his upright fingers. In the Southern Hemisphere the Southern Cross can be used for the same purpose (See Fig.26). However, since its azimuth is not directly south it can only be used when at its zenith, that is when the crux is perpendicular to the horizon (Finney 1991:III:16-18).

Rather than using single zenith stars after the fashion of Lewis, Nainoa chose to use pairs of meridional stars. He had realised that when stars, whose paths across the skies were directly north and south of each other, appeared in an upright manner to the observer, then they had in fact become aligned with the observer's meridian and could therefore be used to calculate latitude. To achieve the calculation Nainoa first memorised the angular altitudes of the bottom stars, of several pairs as they passed through the meridian of the equator. The difference between the memorised angular height, of the bottom star of the pair at the equator, and the angular height above the horizon, as observed by the navigator equalled the equivalent latitudinal position of the canoe. For instance, from the equator the meridional pair of the Southern Cross passes the meridian with the bottom star approximately twenty-seven degrees above the horizon. Therefore, if one is sailing in the Southern Hemisphere and calculates the bottom star of the crux at seventeen degrees above the horizon as it passes through the meridian, then one's latitude is about ten degrees south (Finney 1991:III:18).

Some questions remain in respect of both voyages. Firstly, although much attention was paid to designing the *Hokule'a* and *Nalehia* along traditional lines the materials were almost wholly modern. Secondly, although the performance of both canoes was

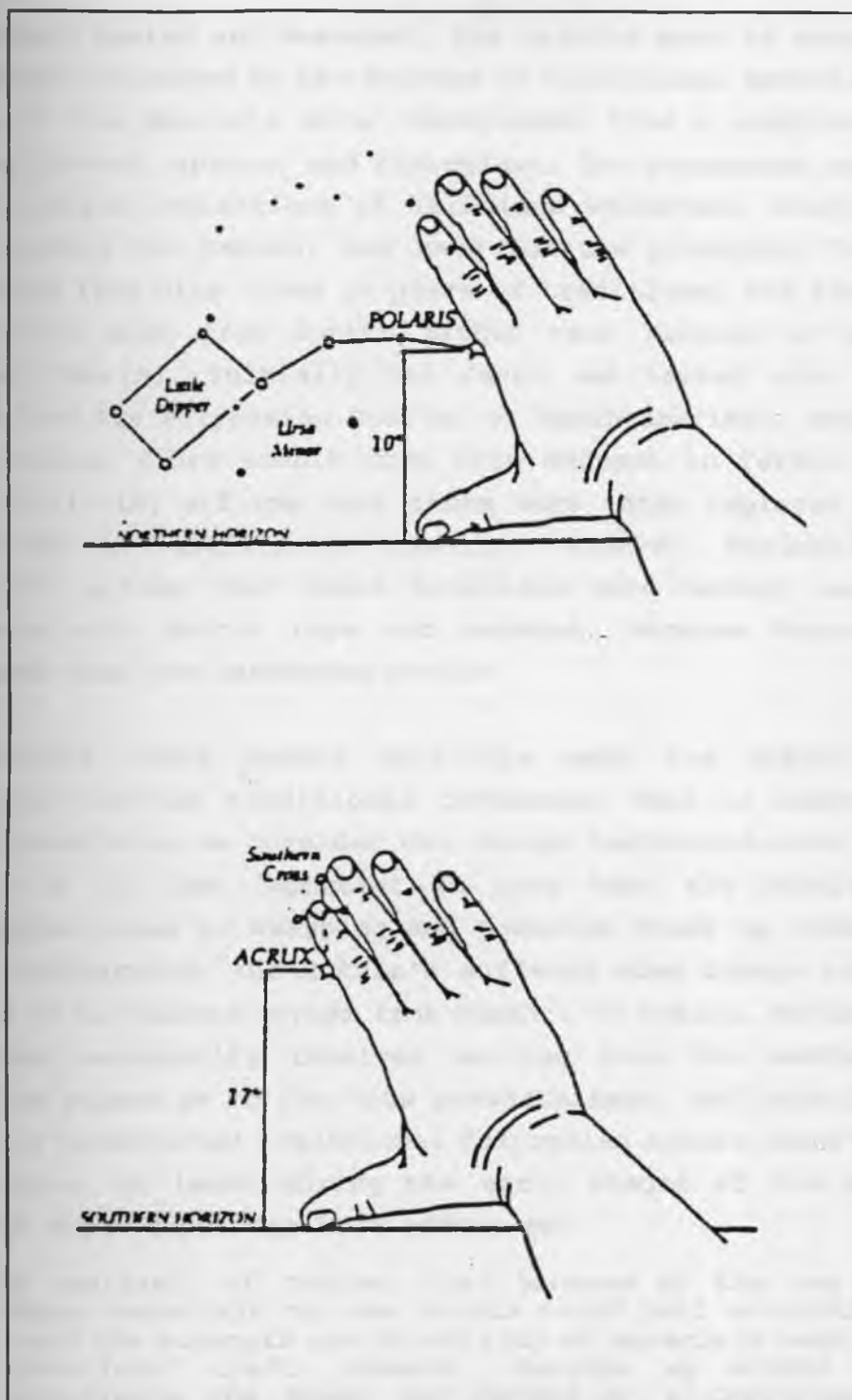


Figure 26: Calculating Latitude using Polaris in The Northern Hemisphere and the Meridional Pair of The Southern Cross in The Southern Hemisphere (Finney 1991:III:17-18).

rigorously tested and measured, the results must to some degree have been influenced by the absence of traditional materials. The hulls of the *Hokule'a* were constructed from a combination of marine plywood, spruce, and fibreglass. The crossbeams were made from multiple laminations of half inch white-oak. Douglas fir, substituting for bamboo, was used for the planking. The masts were made from pine trees in place of traditional koa trees. The sails were made from cotton rather than launaha or pandanus (Morse 1984:15). Initially the canoe was tested with launaha sails from the Polynesian Outlier of Kapingamaringi, and lashed with coconut fibre sennit rope from Nanumea in Tuvalu. Finney (1991:II:17-18) affirms that these were later replaced because there was an insufficient quantity. However, Froiseth et al (1984:91) writes that these materials were tested, and later replaced with dacron rope and canvass, because these proved stronger than the handwoven crafts.

Undoubtedly these modern materials make the *Hokule'a* much stronger than her traditional forebears. This is additionally significant when we consider the design restraints such as beam width. It is also important to note that the *Hokule'a* was considered prone to swamping and possible break up under heavy seas. Furthermore, the *Hokule'a* suffered some damage under the stress of her second voyage from Hawai'i to Tahiti, because such a voyage necessarily involves sailing into the weather. The question arises as to the true seaworthiness, and durability of properly constructed traditional Polynesian canoes under similar conditions. At least during the early stages of the *Hokule'a* project these questions were addressed:

We realized, of course, that because of the use of modern materials our sea trials could tell us nothing about the strength and durability of materials used in traditional craft. However, because we strove to approximate the shape and weight of a traditional canoe, we felt that our vessel would be a 'performance accurate' reconstruction that would sail and handle much like the voyaging canoes that once sailed in Polynesian seas, and hence tell us much about voyaging capabilities in earlier centuries (Finney 1991:II:18).

Given all these considerations, it is possible that in pre-

European times the level of difficulty and stress on equipment may, over the long term, have been quite a deterrent to frequent continuous sailing, at least between Hawai'i and Tahiti.

The presence of escort vessels on both voyages, and of the satellite transmitter on the second, also raises questions about the integrity of the 'traditional navigation'. For example, if the escort vessel were navigating its own way using modern equipment, did this in anyway allow the crew of the *Hokule'a* to follow? Certainly at one point on the sixth day of the second voyage to Tahiti, the *Ishka* was reportedly sailing ahead of the *Hokule'a* (Kyselka 1987:135). It is also clear that during the second voyage at least the *Hokule'a* had access to daily weather reports by radio. How unassisted were her voyages?

The support yachts also carried water and provisions for both crews on both voyages, which raises other questions about survivability over long distances, and the optimum number of crew on ancient canoes (Kyselka 1987:155-156).

During the sea trials for the second voyage a forty-horsepower outboard engine was used to manoeuvre close into shore (Kyselka 1987:75). The engine was also used to depart Hawai'i. There is a question as to whether or not the motor was ever used at sea. During the Tonga to Samoa leg of the mid-1980s Voyage of Rediscovery there is at least one example of it nearly being used (see Chapter Six).

Although Piailug was the principal navigator on the first voyage, he was also supported by David Lewis who assisted him in identifying zenith stars. The problem here is that Lewis had made free use of European charts during his voyage to New Zealand and may have done so again. In one sense, astronomical navigation has three components: the first is the canoe, the second is learning to identify particular stars, and the third to observe those stars while at sea. In the case of Lewis's voyage to New Zealand the first and second components were European and non-

traditional, it was only the observation in the absence of a compass or sextant that was traditional. In the case of the *Hokule'a* the canoe looked traditional, but was modern, the courses were also European in reference, and the third element traditional as before. In this sense the voyages of the *Hokule'a* are closer to an authentically traditional one, but are certainly some way from being completely so. Finney's comments are worth noting:

By sailing *Hokule'a* between, for example, Hawai'i and Tahiti, or Rarotonga and Aotearoa, we cannot claim to have 'proved' that earlier canoe voyagers did so intentionally or exactly as we did. But we can claim that by building a canoe that sailed more or less as an ancient voyaging craft, by relearning how to navigate without instruments, and then by testing our craft and relearned skills over legendary voyaging routes, we have gained realistic insights on sailing performance, navigational accuracy, and how to use seasonal and shorter-term variations in wind direction to sail where you want to go that relate directly to questions concerning how the Polynesians discovered and settled their islands, and to what extent they were able to voyage back and forth between distantly separated islands (1991:P:4).

CHAPTER SIX

HOKULE'A 1985-1987

In 1985 a third 'Voyage of Rediscovery' was undertaken. The *Hokule'a* sailed from Hawai'i to Tahiti, through the Society Islands to Rarotonga, then on to Aotearoa, Tonga, Samoa and back home to Hawai'i via Rangiroa (See Fig.27). The ARGOS satellite system was again used to track the canoe, and frequent positional fixes were made with the satellite navigation receiver aboard the *Dorcas*, the new escort yacht for this 12,000 mile voyage (Finney 1991:IV:2).

Hawai'i to Tahiti 1985

During the late spring and early summer, storm-free, trade winds predominate between Hawai'i and Tahiti. The 1976 and 1980 voyages had departed Hawai'i during the early spring in order to be able to make the return from Hawai'i before late summer. The 1985 expedition was under no such demand and a June departure was planned. However, due to delays in readying the canoe and yacht, they did not depart until July. Instead of the steady trades interrupted by the calms of the doldrums the *Hokule'a* encountered a series of calms, squalls and adverse winds. The doldrums had also shifted to a position several degrees north of where they had been situated on the earlier voyages. These conditions, coupled with repeated and unexpected sightings of 'land birds' in the empty seas south of the equator, changed what had come to

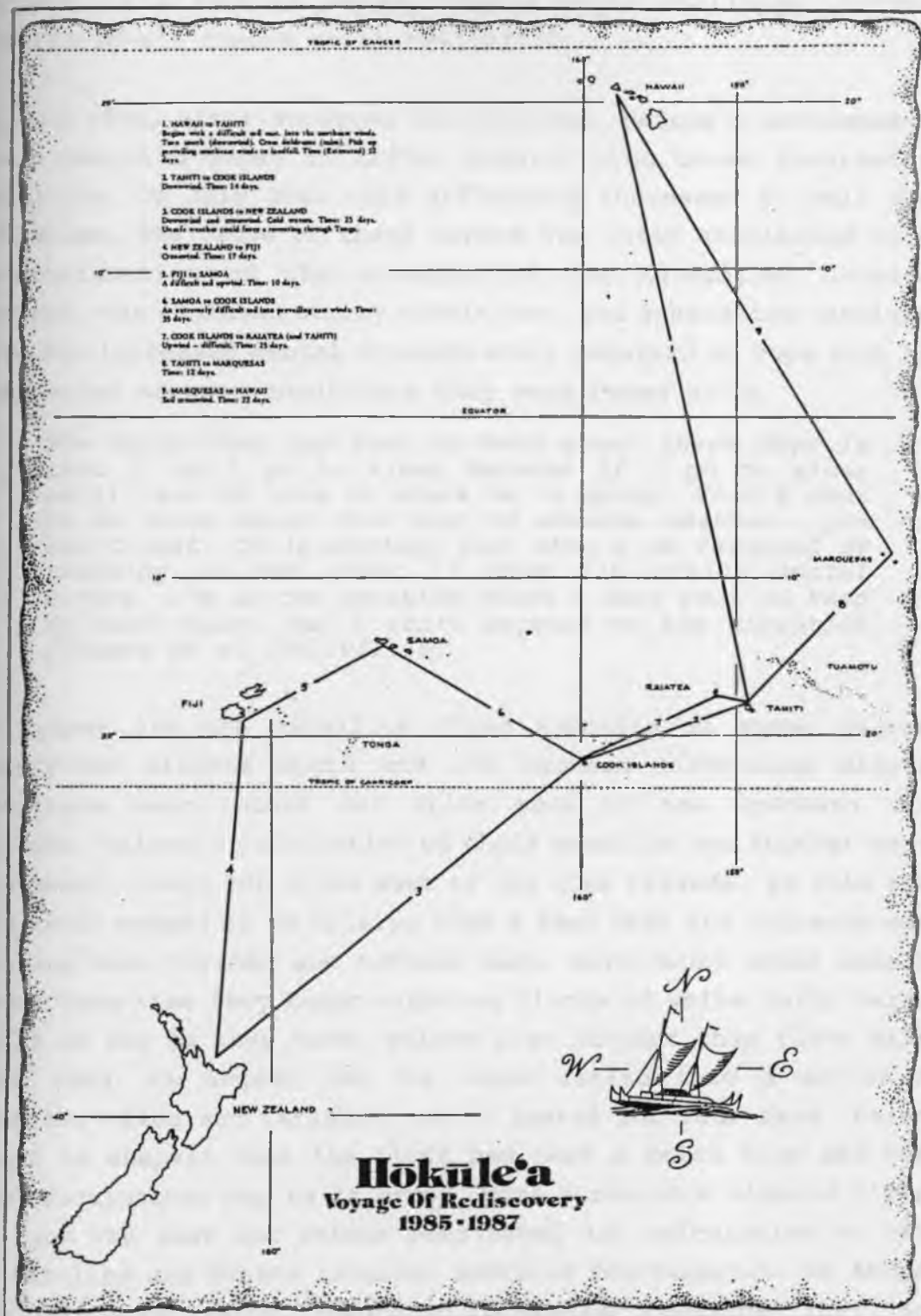


Figure 27: The Voyage of Rediscovery 1985 to 1987 (Evenari 1986:36).

be seen as a routine voyage into a major challenge. (Finney 1991:IV:10-11; Crouch et al 1991:VII:7).

On July 23rd, after entering the doldrums, Nainoa's estimates of their position began to differ greatly from those recorded by satellite. On July 25th this difference increased to well over 200 miles. The cause of these errors was later attributed to an underestimation of the strength of the Equatorial Counter-current, the confused stormy conditions, and exhaustion resulting from the increased mental concentration required to cope with the unexpected adverse conditions they were faced with:

The thing that has been so hard about these days is that I can't go to sleep because if I go to sleep we'll have no idea of where we're going. That's what is so tough about this kind of adverse weather...you can't rest. It is showing that when I am fatigued my thinking is not clear. I know I'm making mental errors. I'm in the position where I need rest to keep my head clear, but I can't because of the situation (Crouch et al 1991:VII:16).

On August 1st the satellite fixed Hokule'a at three degrees twenty-two minutes south and 146 degrees fifty-nine minutes longitude west, about 500 miles east of the Southern Line Islands. Nainoa's calculation of their position was further west-southwest, about 200 miles east of the Line Islands. At this time the error seemed to be arising from a fear that the currents were pushing them further and further east. More doubt arose when at about this time they began sighting flocks of white fairy terns, which as far as they knew, seldom flew further than fifty miles from land. On August 2nd the canoe sailed into a series of squalls, calms and variables which lasted for four days. Nainoa began to suspect that the birds had been a false sign and that his calculations may be in error. More birds were sighted flying in from the west and Nainoa readjusted his calculation to east of Carolina and Vostok islands, north of the Tuamotus. On August 8th Nainoa estimated, according to stellar readings, that they should be approaching the northernmost Tuamotus, but in the absence of land signs, including birds, began to wonder if his earlier fears of being too far east were true. The following day

they sighted several flocks of birds, noticed a change in the swell pattern, and fortuitously, also sighted a passing plane. The following day the *Hokule'a* made landfall on Rangiroa atoll in the Tuamotus, then sailed to Tahiti, arriving after thirty-two days at sea (Crouch et al 1989:VII:18-24).

Tahiti to Rarotonga 1985

After the August arrival in Tahiti it was decided to wait until November before sailing for New Zealand, when the winds would be more favourable for departing the tropics. After a short stay in Tahiti, the canoe was sailed along a leisurely route through several of the islands in the Society Group, before arriving in Rarotonga during mid-September (Finney 1994:IV:4, 11-12).

This section of the voyage was partly a goodwill cruise, and partly an exercise in close-quarter inter-island sailing. From Pape'ete, in the northwest of Tahiti, the *Hokule'a* sailed across to Mo'orea where the crew were hosted by a group known as 'Pupu Arioi', so named after an ancient Tahitian cult described by Cook. There, they underwent ritual purification by fire-walking over hot stones so that they could then enter the lagoon of Ra'iatea through the sacred passage of Teavamo'a, and pay their respects at the marae of Taputapuatea (Finney 1991:IV:13-14).

Having completed the ceremony, and after resting all day the *Hokule'a* sailed forty-five miles southwest toward the small island of Mai'ao, then using that island as a backsight, turned north and proceeded toward Huahine, about fifty-five miles north-northwest. During the night, the sight of surf breaking off to starboard told the crew they had arrived in Huahine. They rested there for two days then sailed to Ra'iatea, and after visiting Taputapuatea, went on to Uturoa, the main town and harbour of Ra'iatea. They later crossed to Borabora, the last major island in the Society chain, and after resting there a further three days because of bad weather, sailed for Maupiti, just visible on

the horizon, on the morning of September 7th. As the *Hokule'a* left Borabora, she swung northeast toward Tupai. The crew were able to detect this small atoll while still beyond the horizon because of the greenish tinge its shallow lagoon cast on the underside of passing cloud. They sailed close by Maupiti, then using it to take a bearing, headed for the atoll of Maupiha'a on the western edge of the Society Group, where Nainoa negotiated a safe night landing (Finney 1991:IV:15-16).

The next task was to cross the 400 miles southwest to Rarotonga by firstly striking one of the four islands, being either Ma'uuke, Mitiaro, Atiu or Takutea. Then, using whatever island was hit as a reference point, reset a course for Rarotonga. Nainoa approached the four islands at an angle that presented them as the broadest possible target screen. Unfortunately the weather on the third day out of Maupiha'a, when they expected to strike the islands, was cloudy and overcast. This raised the possibility that the *Hokule'a* might unknowingly pass right through them. However, at about eleven o'clock a few white terns flew past the canoe and shortly after land was sighted. They landed at Mitiaro. Around sunset they began the last 140 miles southwest to Rarotonga. Some concern was expressed that they might run into Atiu, lying about fifty miles west-southwest, during the dark, so a slightly more westerly course was set in order to pass it. The following day, on September 14th, they arrived safely in Rarotonga (Finney 1991:IV:17-20).

Rarotonga to Aotearoa 1985

By sailing to Aotearoa the crew hoped to shed some light on how the ancestors of the Maori might have migrated from Eastern Polynesia (Morse 1984:3; Finney 1994:55). Nainoa Thompson consulted Elsdon Best's (1925b) The Maori Canoe where he found summaries of the sailing directions allegedly left by Kupe, and the routes taken by the *Kurahaupo* and *Takitumu*. He found that although the sailing directions recorded in the different legends

and versions varied, in general they agreed that the best time to sail to Aotearoa was during late October and November with the canoe's prow pointed toward the left or right of the setting points of the sun, the moon and Venus (Babayan et al 1987:169).

Although vague, Thompson thought that these directions were adequate enough to hit such a large target, as New Zealand presented. The directions also seemed in accord with his meteorological research, as was the testimony of yachtsmen that the warmer months from November to March were those most favourable for such a voyage. During this time the prevailing westerlies of the lower latitudes move south and are replaced by spells of easterly winds. It was thought that these winds brought on by high pressure systems would allow the *Hokule'a* to maintain a southwesterly course after moving beyond the trade winds of higher latitudes. This period is also marked by tropical cyclones so the departure date was set for mid-November before the cyclone season (Babayan et al 1987:169; Finney 1994 :56-57).

After some bad weather the *Hokule'a* departed Rarotonga on November 21st. Using backsights on the land, she steered southwest before the trade winds (Babayan et al 1987:166-169). As Rarotonga fell behind they steered toward the setting sun as had, according to tradition, their Polynesian forebears centuries before them:

Our hope was that we would be able to make a smooth transition from the southeast trades to easterly winds associated with the passage of high pressure systems moving from west to east across the seas around the latitude of the North Island. In the Southern Hemisphere surface winds circulate counter-clockwise around a high; we wanted to sail along the northern, equatorward flank of passing highs in order to take advantage of the easterly wind-flow to be found there. After several days of sailing in moderate southeast winds and under flat-bottomed cumulus clouds typical of trade-wind skies, high cirrus clouds appeared and the wind backed around to the east. We took these signs as indications that we had left the trades and were sailing with easterly winds along the northern flank of a passing high....As high pressure systems are constantly moving eastwards, we realised that we would eventually lose these favourable easterlies. At

this time of year low pressure troughs are typically sandwiched between the passing highs. If these troughs are intense and slow moving, they can bring long spells of westerly winds. We were therefore prepared for the worst when the winds began to back to the northeast, indicating that the centre of the high had moved well to the southwest of us; but unfortunately we never encountered the feared westerlies. Instead, after a day or two of light winds and one brief calm spell, we picked up southeasterly winds which indicated to us that we were once again sailing along the top of a passing high (Finney 1994:57-58).

Upon their return to Hawai'i an examination of meteorological charts for the period confirmed what they had experienced (See Fig.28). Steering the *Hokule'a* close to the southeasterlies was relatively simple. With the sails trimmed, and the load of the provisions properly distributed the canoe, having a natural weather helm, automatically swung to windward. However, steering the canoe with a strong beam, or abaft of beam wind was an arduous task and as the wind moved to a more easterly bearing the crew had to use an eighteen foot long steering paddle, run deep in the water to keep her on the correct bearing off the wind. The steerer's job was to hold the paddle, mounted inboard of the windward hull, deep into the water in order to shift the centre of lateral resistance of the hull towards aft. This prevents the bow from swinging toward the wind. The paddle must be constantly adjusted. If it is too shallow the bow will swing windward, if too deep the canoe will fall off and run downwind (Babayan et al 1987:170).

Within eleven days the favourable easterlies had placed them within a few hundred miles of the Kermadecs, lying northwest of the canoe. On December 3rd they encountered showery weather and light shifting winds. An attempt was made to reach Raoul, the northern most island of the Kermadecs. However, more northwesterly winds prevented them from heading in that direction. The attempt was abandoned and they headed directly for Aotearoa. The following day they sighted Curtis island, one of the three southerly islands of the Kermadecs. Later Macauley island was sighted. Sailing between these islands Nainoa Thompson

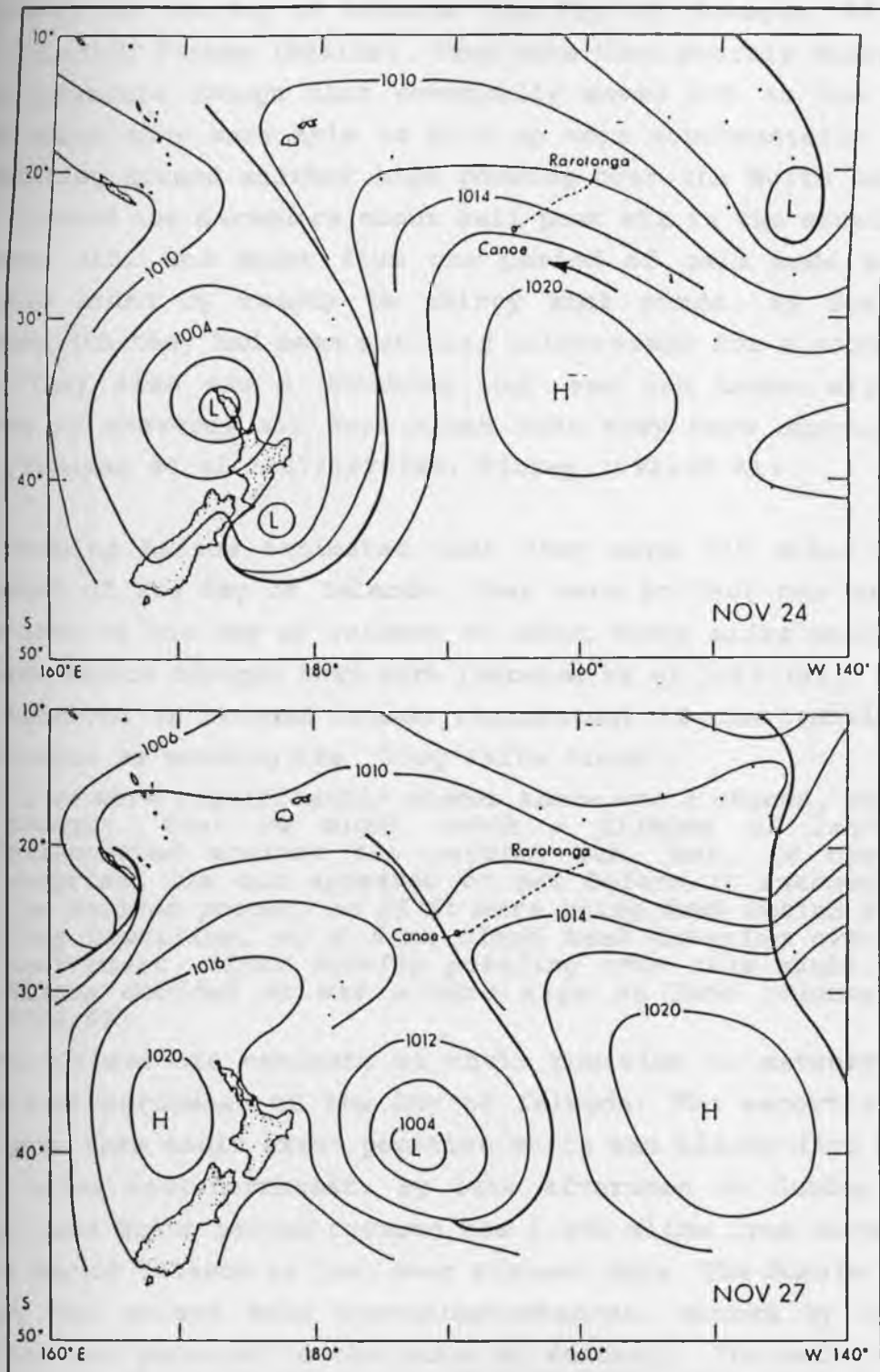


Figure 28: Weather Patterns and Position of the Hokule'a November 24th and 27th (Finney 1994:59, 60).

was able to set an exact course, not only for Aotearoa, but more precisely for the Bay of Islands (See Fig.29)(Babayan 1987:174-175, 182-185; Finney 1994:58). They were then shortly delayed by a low pressure trough that eventually moved off to the east, after which they were able to pick up more southeasterly winds circulating around another high passing over the North Island. They cleared the Kermadecs about half past six in the morning on December 5th, and apart from one period of calm made steady progress aided by twenty to thirty knot winds. By Saturday December 7th they had been noticing albatrosses for a couple of days. They also saw a drifting log, and had begun sighting patches of seaweed, all sure signs that they were approaching land (Babayan et al 1987:187-189; Finney 1994:60-61).

That evening Nainoa estimated that they were 125 miles east-northeast of the Bay of Islands. They were in fact one hundred miles east of the Bay of Islands or about forty miles southwest of where Nainoa thought they were (Babayan et al 1987:189). Later they observed an unusual sunset reminiscent of one translation of Aotearoa as meaning the 'long white cloud':

If we were significantly closer there was a chance, we thought, that we might catch a glimpse of land silhouetted against the setting sun. But, to our surprise, the sun appeared to set before it reached the horizon proper, as if it were going down behind a long coastline, or a dark cloud bank hovering over that coast. After briefly puzzling over this sight, Nainoa decided it was a sure sign of land (Finney 1994:62).

Nainoa revised his estimate of their position to seventy-five miles east-northeast of the Bay of Islands. The escort vessel then gave them their exact position which was ninety-five point seven miles east-northeast. By late afternoon on Sunday they passed Cape Brett having covered the 1,650 miles from Rarotonga to the Bay of Islands in just over sixteen days. The *Hokule'a* was met by the modern waka *Ngatokimatawhaorua*, manned by eighty paddlers and escorted to the marae at Waitangi. The main reason for the swift passage of the *Hokule'a* to Aotearoa was that at each stage of the voyage they had been fortunate enough to be positioned along the northern flanks of highs moving from west

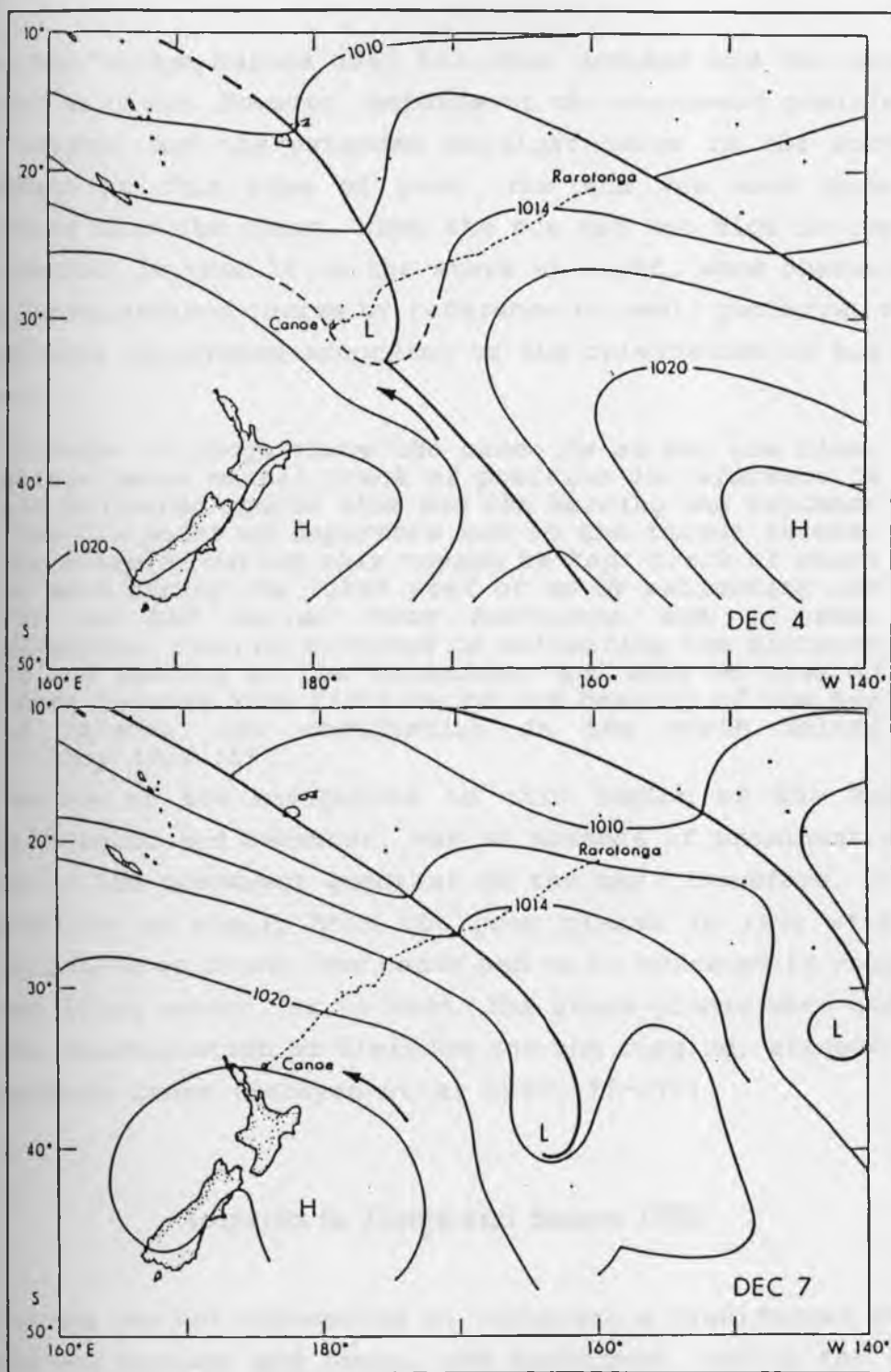


Figure 29: Rarotonga to Aotearoa 1985 (Finney 1986:54).

to east toward New Zealand (Babayan et al 1987:190-191, 194; Finney 1994:62-64).

During the voyage Nainoa used his star compass and the moon to navigate at night. However, because of the southwest position of their voyage, and the extended daylight hours in the Southern Hemisphere at this time of year, the sun was used more for navigating than the stars. When the sun was too high in the sky to be useful, or when it or the stars at night, were obscured by cloud, he maintained course by reference to swell patterns, which in turn were calibrated according to the orientation of his star compass:

In order to judge where the canoe is at any one time, Nainoa keeps mental track of position in reference to his projected course line and the bearing and distance from his point of departure and to the target island. For example, during this voyage he kept track of where we were during the first week or so by estimating how far we had sailed from Rarotonga and in what direction. Then he switched to estimating the distance to and bearing of the Kermadecs, and once we cleared these islands, the distance to and bearing of the Bay of Islands, our destination in the North Island (Finney 1994 :59).

One feature of the navigation in this region of the Pacific during November and December, was an absence of prominent stars setting in the southwest quadrant of the sky. Therefore, it was not possible to simply hold the prow pieces in line with the setting points of stars. The canoe had to be oriented in relation to stars lying astern, or to beam. The stern pieces were aligned with the constellation of Pleiades and the rigging, aligned with the Southern Cross (Babayan et al 1987:177-179).

Aotearoa to Tonga and Samoa 1986

This voyage was not attempting to replicate a traditional voyage between New Zealand and Tonga, and therefore, during the early stages at least, the rules governing the exchange of navigational information between the escort yacht and the navigator of the

Hokule'a, in this case Chad Babayan, were relaxed (Finney 1991:IV:20-21).

The canoe was readied in April, and departed May 1st heading north-northeast with the aid of westerly winds. Babayan navigated the canoe to the Kermadecs after which they turned to cross the 500 mile gap to Tonga. Upon leaving the Kermadecs the winds eased, and began blowing from the southeast and east, reaching gale force the following night. After three days of winds gusting between forty to fifty knots and high seas Tongatapu and Eua were sighted (Finney 1991:IV:21-24).

On Thursday 14th May the Hokule'a departed Nuku'alofa in Tonga. On the first night their bearing was two houses east of north on the thirty-two house compass developed by Thompson. They estimated their speed at five knots by looking over the side and calculating how fast the water passed certain points on the boat. On May 17th they landed at Lifuka in the Ha'apai Group. The following day they departed for Vava'u (Evenari 1986:39-40).

Steering involved lining the bow of the hulls or other parts of the canoe with certain reference points:

Once on course, I find a visual fix, or marker. It might be positioning the manu, or point of the bow, directly on a star ahead. Or perhaps finding a star that falls in between the shrouds of the main. Or maybe there are no stars, and I line up a certain part of a shroud or halyard with a particular cloud pattern - until the cloud moves or the course changes (Evenari 1986:40-41).

During the night of May 18th to 19th their course required them to pass through several islands and scattered rocks while being guided by a Tongan pilot. They achieved this better with his help than did their escort boat the Dorcas with its radar, charts and other modern equipment. However, Gail Evenari's diary for that night records that there was one point where Nainoa and other senior members of the crew were ready to use the outboard motor to help steer them out of potential danger. The Hokule'a made

landfall in American Samoa on May 25th (Evenari 1986:41-42).

Samoa to Tahiti 1986

This leg of the voyage was perhaps one of the most difficult because it meant sailing west to east in contrary direction to the predominant southeast trade winds between Samoa and Rarotonga, and the predominant easterlies that blow between Rarotonga and Tahiti. Basically there were two options for making this voyage: either tacking into the trades, which would add an enormous amount of sailing distance, or waiting for favourable changes in the prevailing patterns of weather. Cook had noted that the Polynesians took advantage of such changes to sail eastward, during the months from November to January when the southeast trades died down and were replaced by northwesterlies.¹⁴ More recently, research undertaken by the Polynesian Navigation Society had revealed that when the summer El Nino change in wind and current patterns occurred, these northwesterlies tended to last longer and could extend farther across the Pacific than usual. However, these changes could also bring cloudy skies, rain, and high seas which, particularly in West Polynesia, could develop into dangerous hurricanes. These hurricanes could also sweep right across the Pacific into East Polynesia. It had also been discovered that even during the months from June to August, when the trades were at their steadiest, occasional changes occurred as low pressure systems moved eastward. These systems would cause the predominant winds to swing from the southeast to the northeast, then move slowly counterclockwise while returning to the southeast. Given all these factors Nainoa decided it was safer to depart during the Southern Hemisphere winter. It was determined that with the wind blowing anywhere between the north to the west and south the *Hokule'a* could easily sail east (Finney 1986:48; Finney et al 1989:270-271).

¹⁴ See Chapter Two.

The *Hokule'a* left Samoa on July 7th tacking against the easterly trades (See Fig.30). On July 10th the wind began shifting to slightly north of east. Nainoa correctly read this as sign of an approaching trough. He put the canoe on a southeasterly heading and made ready to sail before the westerly winds the trough would bring. On July 11th the wind swung north, and the following day dark clouds were sighted which announced the approach of the expected trough. As the system passed overhead the crew were able to take advantage of wind shifts to the northwest, west and southwest and make good easting. On July 13th the trades returned (Finney et al 1989:275-277; Finney 1994:49).

On July 15th the *Dorcas* began having trouble with the heavy seas and her mast. An agreement was made to inform the *Hokule'a* of the exact position of both vessels so that a course could be set to the nearest island, Aitutaki about 140 miles away. Nainoa found out that he had underestimated his position by 125 miles. Later this error was attributed to the more than frequent amount of tacking that had been made in order to take advantage of the multi-directional winds being utilised. The *Hokule'a* was also sailing with larger than usual sails, and Thompson may have underestimated her speed (Finney et al 1989:277-278).

Early in August the voyage was resumed and they headed for Rarotonga. Chad Babayan was the navigator for this leg. He obtained a southerly bearing by keeping the canoe in line with two land-based, backmark reference points. The first was a small islet on the reef, and the second several peaks on the central mountain core of Aitutaki. During the night he used the Southern Cross to navigate and the following morning they sighted Rarotonga (Finney et al 1989:280-281).

A similar strategy was adopted for the leg between Rarotonga and Tahiti. Because Rarotonga lies four degrees south of Tahiti it was planned to use the westerly flows to make good easting, and the dominant trades when they returned to make the required north-northeast progress. With the arrival of a convenient

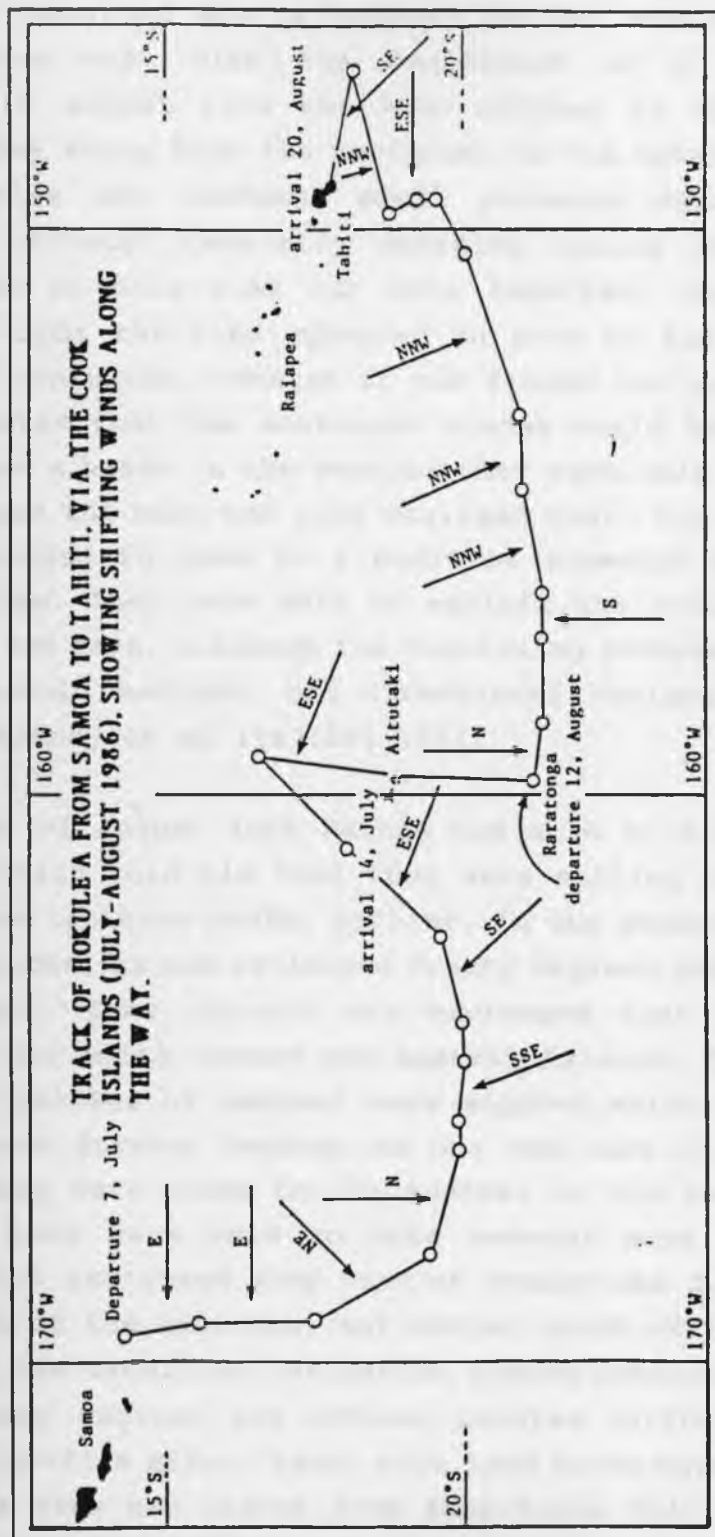


Figure 30: Samoa to Tahiti 1986 (Finney 1986:54).

trough they departed Avarua harbour on the morning of August 12th, sailing east with the assistance of a twelve knot northerly. On August 13th the wind shifted to the west, and during the day swung from the northwest to the southwest. Rainy, overcast skies and confused swell patterns made navigation difficult, although generally speaking making good easterly progress was at this time far more important than accuracy. During the night the wind appeared to move to the north which caused some confusion, because if the trough had passed them by it was expected that the southeast trades would have returned. Finally after a break in the weather they were able to get a fix on Jupiter and the moon and then realised that, for some reason, they had managed to move to a position somewhat ahead of the weather system. They were able to exploit the trough eastwards for another two days, although the continuing overcast conditions made positional readings, and directional navigation somewhat difficult (Finney et al 1989:281-183).

On the night of August 15th Nainoa was able to sight the star Cassiopeia which told him that they were sailing along twenty-three degrees latitude south. Earlier, in the absence of stellar reference guides, he had estimated twenty degrees and twenty-five minutes south. Some concern was expressed that they may be sailing too far south toward the Austral Islands. The following day several patches of seaweed were sighted which confused the situation even further because no one was sure if the seaweed indicated they were close to the Austral or the Society group. That night they were able to take several more astronomical readings which indicated they were at twenty-one degrees south, safely north of the Australs, but rather south of Tahiti. Later checking of the satellite navigation system confirmed that they were at twenty degrees and fifteen minutes latitude south, an error of forty-five miles. Later more land birds were sighted and ignored. The crew had learnt from experience that the sight of a few birds was not a conclusive indicator of nearby land, and were only reliable if a number or several groups of birds were seen flying in the same direction (Finney et al 1989:284-287).

On August 17th the continuing northerly oriented winds were making an easy run at Tahiti more difficult because of the closeness of the angle to the wind required to make northeasting. Briefly the canoe moved ahead of the trough into light east-northeasterly winds and they were able to tack northward. That night they were regathered by the trough and faced off the north wind heading eastward. They were now presented with the problem of sailing too far eastward, past Tahiti and on into the Tuamotu chain of islands. At sunset on August 19th, the wind began shifting to the northeast, briefly died altogether, and was followed by a series of squalls from the west. The following morning a big swell started coming in from the south-southwest indicating that the trough had passed them, and that the southeast trades were picking up again. They headed north-northwest in the direction of Tahiti and a few hours later landed on Mehetia a small island due east of Tahiti. They arrived in Tahiti the following day. The voyage had taken just seventeen days sailing time (Finney 1986:50; Finney et al 1989:287-289).

Tahiti to Hawai'i 1987

The intention on this final leg of the Voyage of Discovery was to replicate a possible early Polynesian voyage of colonisation from the Marquesas to Hawai'i. Because the Marquesas lay to the east of the meridian of Hawai'i they anticipated a speedy return on a broad reach before the trades (Crouch et al 1989:28-29).

The first stretch involved sailing northeast to Rangiroa, situated on the northeastern tip of the Tuamotus, where Nainoa hoped to use the southeast trades to get further northeast to the Marquesas. Rangiroa was selected because of the dangers of sailing among the close knit islands and reefs of the Tuamotuan archipelago. The *Hokule'a* departed on April 2nd with the aid of a east-southeast breeze. Apart from one spell of northeasterlies, favourable easterlies pushed the canoe ahead and on April 4th various land birds were seen, and half an hour later Rangiroa

sighted. Once there the crew settled down to wait for further suitable southeasterlies. However, the canoe was pinned down for three weeks in the Tuamotus by strong northerlies associated with El Nino. Eventually, on April 24th they were able to depart with the assistance of a tropical cyclone, which brought with it a strong easterly wind. The *Hokule'a* was scheduled to attend a ceremony in Hawai'i on May 23rd so the voyage to the Marquesas was abandoned and they headed home. The winds became mainly light and on May 2nd Nainoa's dead reckoning began to diverge from their actual position by up to 150 miles. This error was caused by an overestimation in the set produced by the westerly current, and secondly because Nainoa had been overly conservative in judging the windward performance of the *Hokule'a* in the light conditions (Finney 1991:IV:25-29; Crouch et al 1991:VII:30-38).

On May 10th the *Hokule'a* met with the frigate *USS Brewton* in order to transfer one of the crew with a bad leg infection. The voyage continued to be plagued by frequent shifts in winds that were also, usually light. In one interview Nainoa revealed:

By far this is the strangest trip in terms of being so against the average...To me, it is the biggest challenge I have ever faced, for a number of reasons. One is the length of the trip; it is the longest voyage so far. Two is the weather; the weather has been so unpredictable that you can't stay on a regular sail plan. Three is that we have had to sail perpendicular to our course so many times. So, given all that...it is going to be real interesting to see exactly where we end up (Crouch et al 1991:VII:46).

Because of the constant wind changes the canoe was having to continually tack in different directions and Nainoa became concerned about his ability to judge which side of Hawai'i they would approach it from, the east or the west. Nonetheless, to his credit Nainoa's estimate for May 14th produced a reduced error of 120 miles. Fortunately, from then on the winds became more constant and easterly, although they remained light. On May 16th his latitudinal estimate of eighteen degrees thirty minutes north was basically correct although longitudinally he had calculated their position 150 miles too far west. During the night of May 18th he took a good sighting of the North Star, Polaris, and

estimated they were at twenty-one degrees north or thereabouts. And, since they had seen no land signs determined, quite correctly, that he had overestimated the westward deviation of their course. On May 19th he recalculated their position at 120 miles from Hawai'i and predicted that Mauna Kea lay west-southwest. They were in fact 140 miles east of Cape Kumukahi the eastern most point on Hawai'i. On the night of May 20th they sighted the loom of lights on Hawai'i. The next morning they were taken under tow to Hilo for customs inspection and other formalities and then proceeded to O'ahu for their engagement (Crouch 1991:VII:46-54).

Overall the return took twenty-eight days, one week longer than in 1976 and 1980, because the expected trade winds had only blown sporadically and the canoe had been beset by frequent calms, light winds and squalls. The return to Hawai'i had highlighted the importance of observing swell patterns especially in the absence of being able to make astronomical readings. Not only were swells useful for navigating under cloud cover but sudden large swells often announced the impending arrival of storms (Crouch et al 1991:VII:43, 55-58).

Summary

By the end of this voyage the *Hokule'a* had spent a total of 118 days at sea and, although she cruises at about six to six and a half knots, had averaged four knots or about 100 miles per day, including the times of calms, squalls, and several storms. The voyage spanned two years because several stopovers had been made, so that the crew could get much needed rest. In addition, there were delays waiting for new crew flying in to replace others who had to return to their families and jobs. Other delays were devoted to ceremonies, repairs and maintenance. More importantly, there were times during the voyage when it was deemed preferable to wait for seasonal wind shifts before embarking on the next leg of their journey. At the end of this voyage the *Hokule'a* had been

sailed upwards of 30,000 miles in all training and experimental voyages since 1975 (Finney 1991:IV:1-4).

The voyage from Hawai'i to Tahiti highlighted the need for navigators to be experienced. Nainoa had become very fatigued on this voyage because of the strikingly different conditions they had encountered by sailing later in the year than in 1976 and 1980. At times during the voyage huge errors were made in estimated position. However, to his credit, Nainoa had begun to readjust his calculations toward the end of the leg in the realisation that something was amiss. It is important to remember that in terms of traditional navigation methods, departing and arriving are the main requirements of a successful voyage, rather than knowing exactly where you are at any one time. Depending on the margin of safety, thirst and hunger, how long it takes to arrive at a given destination and what route is taken are secondary considerations to actually arriving. It would be misleading to expect that a traditional navigator could ever match the positional accuracy possible by satellite. Furthermore, it seems characteristic of nearly all the voyages appraised in Part Two of this thesis that the positional errors usually relate to longitude rather than latitude. Moreover, it is equally apparent that once navigators determine the latitude of their target the overall margin of error begins to rapidly decrease. The point is that if the navigator can consistently judge the latitude with some accuracy then the longitude will eventually come into line. Simply put, once the right latitude is reached the target is either east or west.

The leg from Tahiti to Aotearoa proved to a certain degree that a deliberately navigated waka could sail from East Polynesia to Aotearoa. It also supported the computer simulation of Levison, Webb and Ward (1973:55-56) which indicated the extreme unlikelihood of a drift voyage arriving in Aotearoa from Eastern Polynesia. In contrast with the previous leg the accuracy of the navigation was also highly impressive. For example, the *Hokule'a* sailed less than 100 miles more than a direct rhumb-line course

between Rarotonga and Aotearoa (Babayan et al 1987:191-192).

In respect of whether or not New Zealand was settled deliberately or accidentally Finney (1994:66) wrote that to sail there 'one has to want to sail there'. He added further, that they would never have attempted a winter voyage and doubt whether any early voyagers would deliberately sail against winterly westerlies and into increasing cold of lower latitudes:

It therefore seems likely then that Aotearoa was reached by skilled navigators who sailed there on purpose, and who knew how to exploit the summer easterlies to keep sailing to the southwest long after they had left the tropical trade winds behind (1994:66).

That prehistoric Polynesian navigators understood variations in weather to this degree is already well attested:

...ethnographic and archaeological evidence indicates that they were well acquainted with the alteration of westerlies and easterlies in the tropical Pacific, and used these to sail, with favourable winds, from island to island, both to the east and to the west (Finney 1994:66).¹⁵

Sailing to Aotearoa from Eastern Polynesia is contrary to the general trend of Polynesian settlement being west to east. Despite that, Finney (1994:66-67) notes other precedents such as that from the Marquesas to Hawai'i. Other settlement voyages from West Polynesia to several of the Polynesian Outliers are also well documented by Ward (1976), Firth (1961), and, Kirch and Yen (1982).

Another feature of sailing to Aotearoa is that it also means sailing into increasingly colder and unknown seas. Finney (1994:67) proposes three possible reasons why such a voyage may have been undertaken: firstly mariners were following the flight path of the cuckoo and godwit; secondly, a deliberate voyage of exploration was undertaken on the back of seasonal easterlies previously found during other voyages to the south to see where

¹⁵ See also Chapter Two.

they might lead; or thirdly, voyagers having been storm driven out of the tropics may have given up trying to sail back home against the wind, and decided to sail before it.

Criticism, similar to that levelled against the voyage of the *Rehu Moana* by Sharp, can be made against this voyage. The location of Aotearoa, the wind and sea conditions were already known to the crew of the *Hokule'a* so that their voyage also, related less to one of discovery than it did to one of subsequent settlement. A return voyage would have added more to the picture. However, the crew of the *Hokule'a* were more interested in the west-east migration hypothesis and so returned to Tahiti via Tonga and Samoa.

According to Finney a return voyage from Aotearoa although possible, would be difficult (1994:67). One option would include sailing 1,000 miles east then turning northeast to intercept and use the southeast trades to head for the island chains of the Southern Cooks, Australs, Tuamotus and Society Islands. Nainoa Thompson indicated that:

...if he had wanted to sail *Hokule'a* from Aotearoa directly back to Rarotonga or any other island in central Eastern Polynesia he would wait until a high passed far enough to the north so that he could exploit the westerlies on its southern flank to sail due east. After sailing east for a thousand miles or so, Nainoa would then turn north to enter the trade wind zone and to try and find land. Although he thinks that, given the unpredictable winds and the long, dogleg course, it would be virtually impossible to navigate exactly to Rarotonga or any other specific island, Nainoa is confident that he could have made a landfall somewhere along the island screen formed by the Southern Cook Islands and the Austral Islands, or missing this, on the Societies or Tuamotu-Gambier chain. Then he could have gone on to Rarotonga, Tahiti or whichever island would have been the final destination (Finney 1988:401-405).

According to Sutton (1994:254) such a route is significant because not only do the islands between the Southern Cooks and the Tuamotus form a vast arc, which acts as a huge safety net, but also falls archaeologically, within the potential voyaging

network of the prehistoric Maori.¹⁶ However, sailing before the westerlies would be hazardous; the high winds and seas could overwhelm canoe, and the extreme cold the crew. It would be better to wait until summer and sail before the more benign westerlies along the southern half of high pressure systems. In terms of long distance contact being maintained between Aotearoa and islands of the Pacific over long periods, Finney also notes that this would only have been likely if the voyages were attempted during spring or early summer (1994:67-68).

Upon their arrival in New Zealand the crew of the *Hokule'a* were impressed by the blossoming of rata and pohutakawa trees. These bloom during November and December, the period deemed most favourable for a journeying to and from Aotearoa. It is also significant that Maori oral traditions concerning the Aotea, Arawa and Tainui canoes refer to immigrants seeing these very same blossoms and mistaking them for kura (head dresses made from red feathers)(Finney 1994:68-69).¹⁷

The voyage from Samoa to Tahiti showed that a deliberately navigated West Polynesia to East Polynesia expedition was possible by way of exploiting sub-tropical westerly, low pressure air systems, sufficient to make good easting against the prevailing easterly trade winds. That such a deliberately navigated voyage is feasible also supports the idea that pioneering voyagers could have discovered, explored, and systematically settled East Polynesia in like manner. Between Rarotonga and Tahiti the voyage had been:

...at once unforeseeably easy and unexpectedly difficult. Nainoa had anticipated a hard struggle to get the required easting to reach Tahiti - by exploiting the westerly winds of whatever passing troughs they might encounter, and by tacking against the trade winds when necessary. Instead, an embarrassment of northerly and westerly winds sped the canoe eastwards as she stayed within or adjacent to a

¹⁶ See also Chapter One.

¹⁷ See Hiroa (1926:196), Houston (1965:20), Kelly (1949:48), Taylor (1870:266).

low-pressure trough for virtually the entire distance (Finney et al 1989:289).

It is also significant that, whereas a summer west to east crossing had long been considered possible, this voyage showed that such a crossing was possible during both the Austral winter and Austral summer. It is still important to note, however, that such a voyage may not be easy. Certainly the voyage of the *Hokule'a*, particularly between Rarotonga and Tahiti, was made uncomfortable by frequent gale force winds, cloudy skies, squalls and heavy seas. Had the winds been worse then the voyage could easily have taken twice as long as it did (Finney 1986:50; Finney et al 1989:289, 291).

Despite the fact that the voyage could have taken longer, the speed of the crossing raises another interesting point. The orthodox scenario for the settlement of the Polynesia holds that Lapita colonists settled Melanesia, the islands of Santa Cruz, and West Polynesia almost instantaneously, within a few centuries, and that after a pause of more than 1,000 years people from West Polynesia settled East Polynesia.¹⁸ Certainly when considered in the context of several hundred years, a nine day voyage between Samoa and the Cook Group is not a long one, despite the 1,000 mile gap. Another point in this argument is that, although the earliest radio-carbon dates come from the Marquesas, incidently at 1,800 miles the furthest group from West Polynesia, the exploitable sub-tropical westerlies easily reach all the central island groups of East Polynesia. The proposal that earlier archaeological sites are yet to be found in East Polynesia is strongly supported (Finney et al 1989:291-293).

Theoretically, return voyages along the same routes before the trade winds would have been easier. This supports Biggs' (1972:149) view that a '...simplistic view of Polynesian settlement passing from A to B to C in a sequence which never retraces its steps...' is unlikely and that a model of intra-

¹⁸ See Chapter One.

Polynesian migration and settlement is more realistic (Finney et al 1989:293).

After the success of this voyage Finney identified three important requirements in settling East Polynesia: the first was the ability to sail over long distances carrying people, tools, plants and animals, enough to establish new colonies; the second was the possession of large, stable ocean going double-hulled canoes, coupled with the ability to navigate; and the third was an understanding and skill, gained through experience, to exploit spells of westerly winds in order to sail eastward. He felt that to some significant degree the voyages of the *Hokule'a* supported the existence of all three in ancient times (Finney 1989:296).

These epic voyages, launched by the Polynesian Navigation Society, have been journeys of rediscovery, one of the more outstanding features of which, has been the undeniably rapid increase in the ability of the navigators and crews. The voyages of the *Hokule'a* have also severely dented the 300 mile limit placed on non-instrumental navigation by Andrew Sharp. The canoe had also been successfully navigated along routes mentioned in Polynesian oral traditions. Certainly the ease with which some of the voyages were completed restored much credibility to the Polynesian oral traditions.

However, questions still remain about the modern materials and equipment used. For the voyage to New Zealand other modern innovations were also added. The canoe had been painted with anti-fouling paint because of previous problems with barnacles causing losses in speed. Modern, larger, experimental sails were also used. There is also an unconfirmed suggestion that a modern carbon-fibre mast was especially flown in from Canada for this voyage.¹⁹ It was believed that all these changes did enhance the performance of the canoe to some degree making her much faster than her antecedents (Babayan 1987:192-193).

¹⁹ Oral Informant.

There is also a concern about the integrity of the traditional navigation of these voyages. The satellite navigation facilities were present throughout the voyages primarily for the purposes of safety and research, however, there are some indications that they may have had a greater influence than is admitted. For example during the first leg to Tahiti, Crouch (1991) mentions the sighting of an aircraft just before their arrival in the Tuamotus, which suggests that perhaps this influenced how they may have perceived where they were. The implication is that this helped them recorrect their positional calculations, and that they were having some difficulty in getting them right. Free consultation between the navigator and the *Dorcas* occurred during the leg from Aotearoa to the Kermadecs, although admittedly this was because the significance of that leg was perceived as being much less important than the others. Nonetheless, on the voyage from Tonga to Samoa there is further mention that an outboard was going to be used at one point. Direct swapping of navigational information occurred for the reach to Aitutaki, albeit for important safety reasons. Perhaps the key point is that, most of the examples cited here do not appear in the more formal, academic papers but rather in the more informal, booklet publications of just a few pages. Certainly, they tend not to be mentioned by the leading academics associated with the Polynesian Voyaging Society, but rather by the less important and often temporary crew members, reciting their experiences aboard the great waka.

CHAPTER SEVEN

HAWAIKINUI

A few weeks after the 1985 arrival of the *Hokule'a* in Aotearoa another canoe arrived on the east coast. Matahi Greg Whakataka-Brightwell and Francis Puara Cowan had arrived, having sailed the canoe *Hawaiki-nui*, from Tahiti to New Zealand. They had left Rarotonga one week after the *Hokule'a* but encountered less favourable weather conditions. The waka had been delayed several times by storms, calm periods, and the contrary winds of low pressure troughs (Finney 1994:64-65; Nelson 1991:14).

Construction

Matahi Whakataka-Brightwell was born in Masterton in 1954, with tribal links to Ngati Porou, Ngati Raukawa, Tuwharetoa, and Te Arawa. He had become an apprentice carver while working on the Toa Rangatira meeting-house at Takapuwahia (Porirua) in 1976. While on that project he was inspired by his teachers, Kohe Webster and Rua Kaika, to design, build and sail a large, double-hulled ocean-going canoe (Whakataka-Brightwell 1994:2).

In 1979 he started on his project by approaching the Tuhoe Trust Board with a request for two trees for the construction of his waka. They agreed and in December 1979 Matahi went into the Whirinaki forest where, as he recalls:

I had to select the trees myself, which I'd never done

before. But I knew what to look for. I'd been told by my teachers not to select trees at the snowline or on the slope of a hill. The grain would be stronger in the better-nourished trees close to the valley floor.

We were looking for mature trees with thicker bark. Thin bark on totara indicates that the grain is still too loose. Then we looked at the roots. If they're soft and mushy, it means that the taproot is dying and there is a hollow in the tree.

When a tree is dead, standing dead, or doesn't have sound wood, there's often an outcrop like rata vine or kiekie growing in the crown of the tree and a lot of the trees we saw had these problems. The forest ranger also pointed out the devastation caused by possums. We had to compete with them too.

The process continued for five days. I was only allowed to take two trees, so I had to pick the right ones. If I felled a tree that was hollow and rotten, then the chance to build a sailing canoe would be gone. I really had to make my selection carefully.

On the last day, I finally saw two trees that suited my purpose. They were only twenty metres apart. 'These are the two', I told the rangers. Sure enough they were beautiful trees (1994:2-3).

Bill Bendell, a farmer from Pahiatua in the Wairarapa, heard about the project and offered Matahi space at the local marae. The two eighty foot totara logs were transported there and construction began:

For the first two months of construction, we worked on the sapwood, the soft outer layers of recently formed wood between the heartwood and the bark. Adzing reveals what the tree has to offer, and where the faults of the tree are (Whakataka-Brightwell 1994:3).

The heart of the trees was cut out and offered to the people of Pahiatua and Woodville for use as tahuhu (ridgepoles) in meeting-houses. The waka itself was named Hawaiki-nui and each hull separately named, Whareahuru Gilbert and Purewa Tahiwī, after two of Matahi's great-grandparents. Meanwhile one of Matahi's mentors, the carver Rua Kaika, had become very ill. At his request the hulls were transported to Porirua where he could view the progress that had been made (Whakataka-Brightwell 1994:3-5).

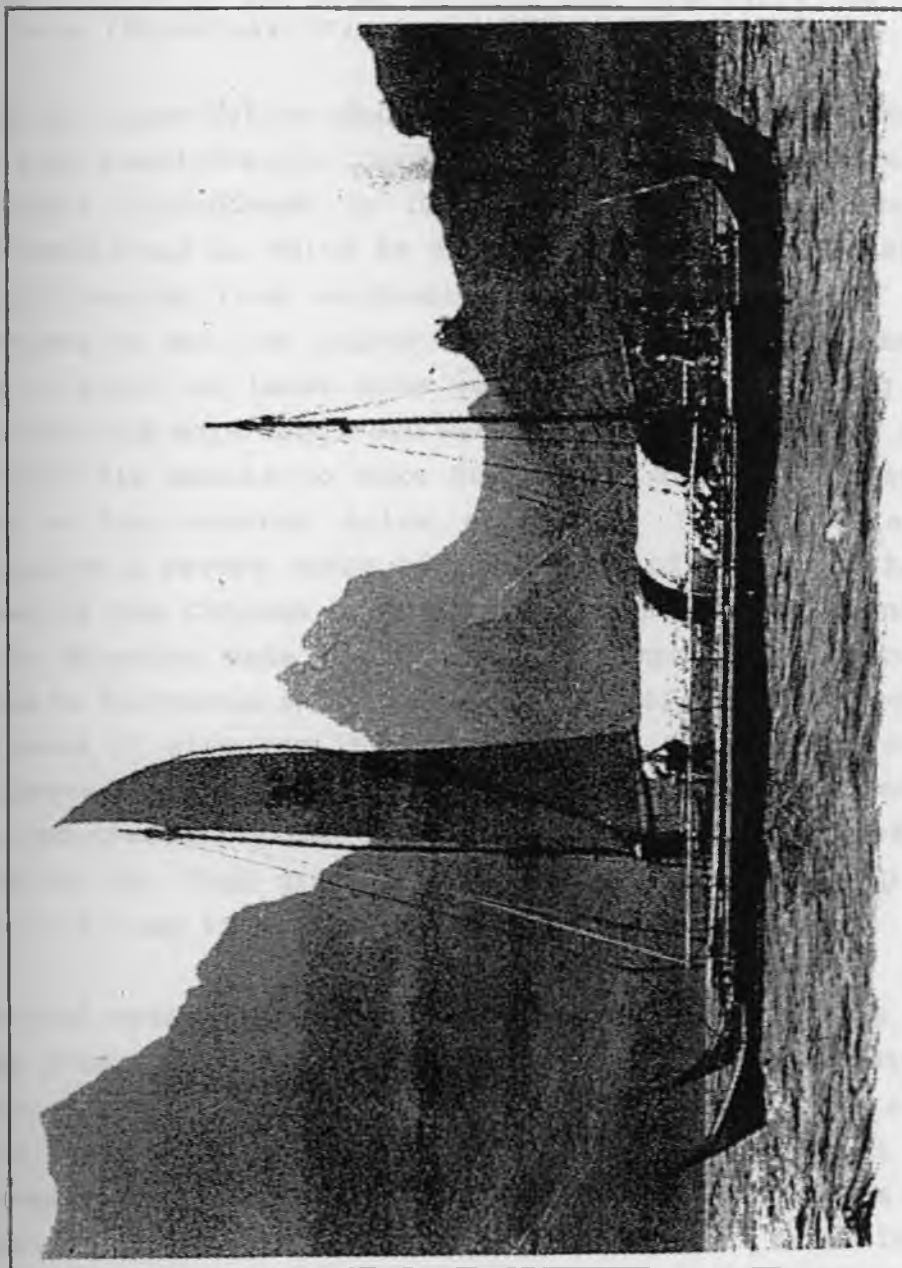


Figure 31: *Hawaiki-nui* off Mo'orea (Whakataka-Brightwell).

There construction continued:

The main job now is to shape the hulls as close as we can to the traditional form. The hull shape of a thousand years ago was like a calabash, very bulbous, and narrow in the upper section and, gradually, we get there (Whakataka-Brightwell 1994:5).

During the construction phase at Porirua Matahi was contacted by a Tahitian named Francis Cowan who had heard of his project while on a visit to Auckland. In 1956 Cowan had built a bamboo craft named *Tahiti-nui* in which he and Eric de Bisschop had attempted a return voyage from Polynesia to Chile. The tactic of this voyage was to sail at thirty degrees latitude south where they hoped to catch at least some westerlies without going too far south into the more dangerous westerlies of the roaring forties. They took six months to make 800 miles. They did however pass within a few hundred miles of Easter Island. Later, they encountered a severe storm off the coast of Chile and had to be rescued by the Chilean navy, the *Tahiti-nui* being abandoned at sea. De Bisschop made a subsequent attempt to sail from South America to Polynesia in a canoe named *Tahiti-nui II*. However, the *Tahiti-nui II* also ran into difficulties and began breaking up in mid-ocean where she had to be repaired. Misfortune struck again and eventually the craft floundered on the reef of a small island in the Cook group. There perished de Bisschop (Nelson 1991:14; Finney 1991:VIII:23-24).

Cowan told Matahi of his long held desire to see a waka make the voyage from Tahiti to Aotearoa. After consultation between the elders of Tuhoe, who had gifted the trees, and those of Tainui and Te Arawa, it was agreed that the canoe be offered to Cowan and make its maiden voyage from Tahiti to Aotearoa. The gift was presented and accepted in a ceremony at Maraeroa marae in Porirua (Whakataka-Brightwell 1994:6).

In 1981 the hulls were transported to Tahiti where work continued for a further four and a half years. In keeping with the desire to make this project as traditional as possible, the *Hawaiki-nui*,

although adzed with steel tools, was constructed wholly from natural materials. This had not been the case for the *Hokule'a*:

...the platform across the two hulls was made from woven strips of bamboo and there was a shelter of woven bamboo on it. The twin masts were also made from bamboo. Other woods used were breadfruit, purau, flacata, mara, atio and uru. The sail was woven from pandanus leaves from Rurutu and the lashings were woven from coconut fibre by women on Raivavae Island (Australes Archipelago). The high front prows were carved with images of ancestors. The raurawa which were made in Aotearoa, were also carved (Nelson 1991:15).

The waka was lashed with coconut sennit rope, made in Rurutu, which required the drilling of 3,000 holes into the craft, and, although Francis and two others worked steadily on the tethering it took seven months to complete. The deck-house was made using traditional bamboo and woven pandanus matting. The mast, constructed from forty foot spars, splints, booms and other bamboo components were treated in salt water. The purpose of this was to render them immune to worm infestation and make them resistant to deterioration in the salty environment they would be used in. Before stepping the mast into the hull a traditional Tahitian rigging system was erected. Matahi had desired that it be of Maori design but conceded to Cowan on the basis of his gift. The sails were woven out of pandanus leaves from Ra'iatea (Whakataka-Brightwell 1994:6-7).

After nearly five years of patient work the *Hawaiki-nui* was ready for sea trials, and over a period of ten months was tested under a variety of different sea, wind and weather conditions. The steering system was perfected last. Matahi knew how to build a waka and Cowan how to rig it but neither yet knew how to make it go in the direction they wanted (Whakataka-Brightwell 1994:8).

Once the trials were completed preparations were made for the voyage from Tahiti to Aotearoa. A crew of five was selected from about 200 applicants. In addition to Matahi and Cowan the crew comprised: Greg Terepai 'Ace' Cuthers from Mangaia as harpoonist, fisherman, cook and steersman; Rodo Paru from Rurutu as fisherman

and steersman; and Alex Roper from London, England, as second navigator and steersman (Nelson 1991:16). Seven had been the number originally intended but the sea trials had proven that, when fully laden with provisions, the optimum number would be five. Matahi estimated that for the purposes of deliberate migration a canoe would have to be twice as big as the eighteen metre *Hawaiki-nui*. The waka was then provisioned with mainly taro, ta'amu, kumara, fish and dried fruit. Water made up the biggest load, it being estimated that each person would require about two litres per day. It was planned to supplement the diet with fish caught while at sea (Whakataka-Brightwell 1994:7-8).

Tahiti to Rarotonga 1985

On October 31st, when the poi-rata (a type of pohutukawa) were in full bloom, and on the night of a new moon, the *Hawaiki-nui* departed from Tahiti on the first leg of her voyage to Ra'iatea (Nelson 1991:15). Whakataka and Cowan had previously been informed by the French authorities that the canoe must first prove its seaworthiness before permission would be given to allow her to leave French territorial waters. Unfortunately, because of a slack half knot breeze, the waka languished mid-channel the best part of a full day waiting for a suitable wind. Then, finally, an appropriate breeze arrived just before dusk and the *Hawaiki-nui* made the 156 kilometres to Ra'iatea in a fast seventeen hours. The crew noted the astonishment of those on the welcoming boats upon witnessing the 'canoe tied together with rope and with a bamboo mast sailing up the lagoon' (Whakataka-Brightwell 1994:7-8).

For the rest of the voyage the crew worked in six hour shifts each being responsible for their own specific, sometimes overlapping tasks. Three were steersmen, one the cook and two were responsible for fishing which involved trailing a long trawl line. On one occasion they hooked a shark which was too big to haul on board. Ace jumped on its back and cut open its stomach

to let some of the weight out. The only modern things they carried were a radio, which later broke down, and a gas cooker for one hot meal a day (Whakataka-Brightwell 1994:9-11).

Three days out of Ra'iatea they were hit by a hurricane, and on the sixth day of the eleven day leg from Mo'orea to Rarotonga four metres broke off one of the masts and crashed onto the deck-house. Despite the difficulties of the weather and the dangers involved they managed to retrieve the mast and sail from the mountainous seas. The canoe drifted for three days while repairs were made. They put out their sea anchor, keeping the bow of the canoe towards the wind and waves, and rode out the storm. Then, having jury-rigged a new mast now two metres shorter than the original, and reefed the sails, they set out once again. To their amazement the canoe carried on at the same speed as before (Whakataka-Brightwell 1994:11).

Whakataka-Brightwell describes the affect the hurricane had on them:

During the hurricane we were faced with 40 foot walls of water, that we were forced to run with. There was no choice. We were faced with the possibility of death at any moment. We had sat in the lap of death, and I tell you that the threat of death makes a man become very focused and concentrated (Whakataka-Brightwell 1994).

Stormy conditions and mountainous seas continued to hamper them, and when they arrived off Rarotonga the still huge waves dwarfed their forty foot mast causing it to disappear and reappear among the waves. Finally they made safe landfall and set to work replacing their broken mast and replenishing their stores. They packed enough water for thirty-six days at sea along with coconuts, wild honey, dried bananas, green bananas, tomatoes, pawpaws, and other fruit. Then after a two week sojourn and on the night of the new moon they departed for Aotearoa (Whakataka-Brightwell 1994:11-12).

Rarotonga to Aotearoa 1985

The *Hawaiki-nui* departed from Rarotonga on November 28th. Storms and gale-force winds hammered the *Hawaiki-nui* for eighteen of the twenty-two days of her voyage to New Zealand. One storm pushed them northward toward the Kermadec reef forcing them to heave to for four days to wait for better sailing. The wind refused to abate and they decided to sail through the reef keeping a close watch throughout the day and night. Eventually, after six days, the storm blew itself out. However, they were then becalmed. At least during this period they were able to make a check on their course after a chance encounter with a New Zealand frigate (Whakataka 1994:12). Finally they reached the Auckland heads (See Fig.32). The *Hawaiki-nui* remained at sea for another thirteen days awaiting the day of their pre-arranged rendezvous at Okahu Bay (Nelson 1991:21).

During the time the *Hawaiki-nui* stood off land she laid anchor off Motiti Island, to the south of Tauranga Harbour. Despite having sailed all that way none of the crew actually had any idea of how to find a safe harbour. They decided to make for the East Coast. Another storm blew up while they were off Mayor Island and this drove them back from the East Cape three times.

Significantly they found coastal sailing was harder than sailing over the open ocean because of the bounce back affect of the currents being reflected off the land. Finally they radioed for help which arrived in the form of the Watties trawler *Kaiti*. They didn't know how to use the radio and only managed to get it working by pushing all the buttons. It was luck. Eventually they were towed into harbour (Whakataka-Brightwell 1994:12-13).

The *Hawaiki-nui* was later transported back to Tahiti to await plans for another voyage (Whakataka-Brightwell 1994:13). Unfortunately, and probably insultingly, the *Hawaiki-nui* has now been commandeered by the French authorities in Tahiti. Its hulls

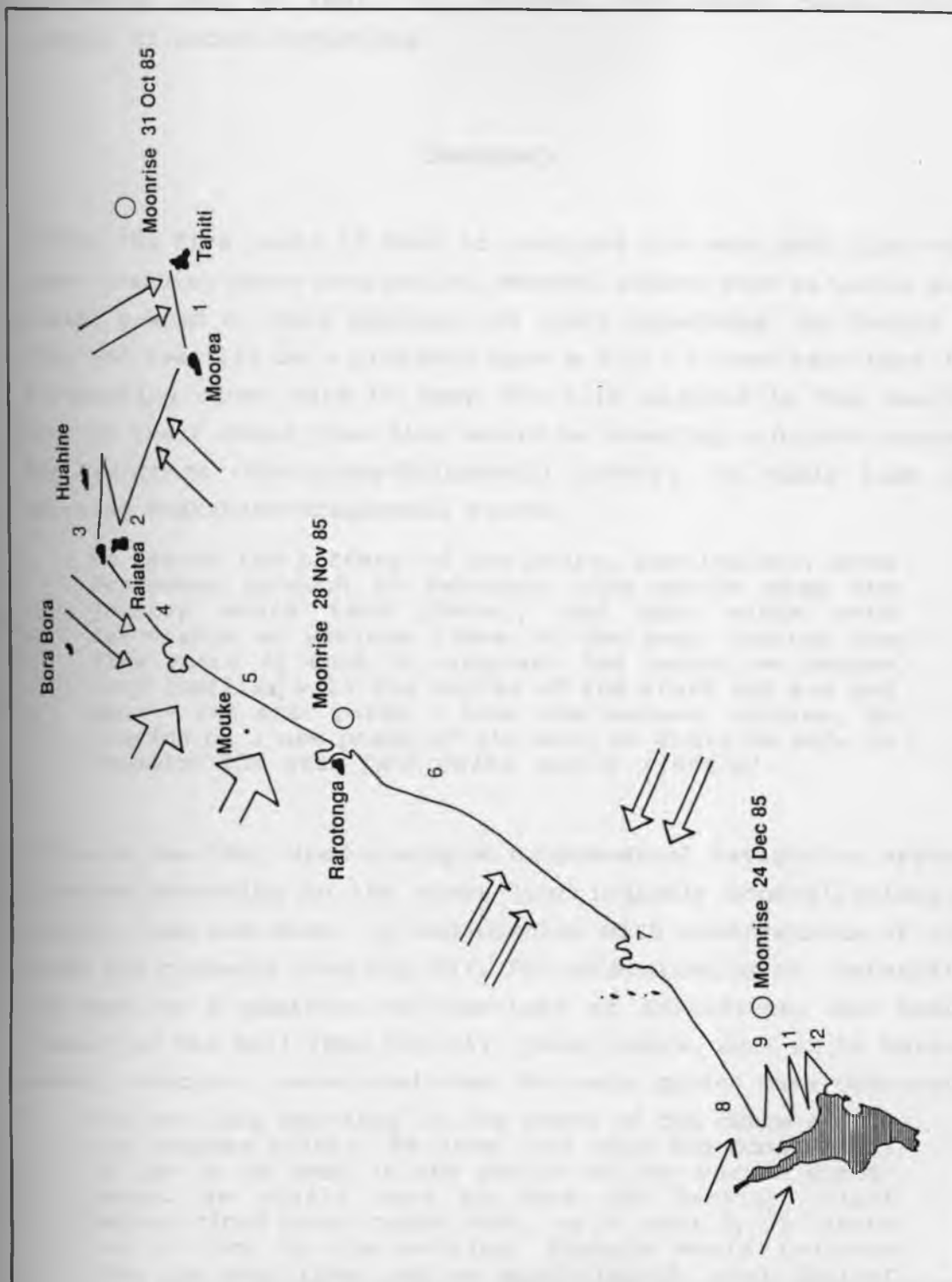


Figure 32: Dates and Course of the *Hawaiki-nui* showing Prevailing Winds and Storms (Nelson 1992:18).

are being used as keels for another renaissance canoe built largely of modern materials.

Summary

During the five years it took to complete the waka much time was spent learning about navigation. Several elders from Ra'iatea and Tahiti passed on what remained of their knowledge. At Tahiti a fire had been lit on a platform upon a hill. It was said that if a departing canoe were to keep the fire sighted in the centre line of their canoe then they would be steering a direct course for Rarotonga (Whakataka-Brightwell 1994:8). Of their time of learning Whakataka-Brightwell wrote:

We learnt the pattern of the stars, particularly from September through to February (the months when the journey would take place), and what winds were favourable at various times of the year. During the five years it took to complete the canoe, we became very familiar with the angles of the stars and sun and moon - the star paths - over the western horizon. By leaving on a new phase of the moon we would be able to remember the star path quite easily (1994:8).

While at sea they used a simple astronomical navigation system oriented according to the stars (particularly constellations), planets, sun and moon, in conjunction with observations of the winds and currents (See Fig.33). The constellation of 'Matariki' was kept to a position on the left of Hawaiki-nui and Kopua (Venus) on the sail (See Fig.34). Other stars, such as Te Matau-a-Maui (Scorpio), were used when the main guides were obscured.

The two long carvings on the stern of the canoe act as our compass points. We know that when the moon rises, it has to be dead in the centre of our carved stern-posts. We really have to have our bearings right before cloud cover comes over, as it usually did about two o'clock in the morning. Francis would indicate when the moon rose, and an arm's length later Jupiter would come over the horizon and then Venus would appear. We would use the edge of the sail as part of our indicator - that's where Venus would rise, on the edge of our sail.

Once we'd got Venus set, we would look for the Southern Cross and the Milky Way, which ran parallel to the Southern Cross over the Western Horizon. Next, the constellation we wanted to see most was Te Ika a Maui or Scorpio. But for twenty-two nights after it appeared, clouds began covering the sky. We would make sure that we had streamers running to indicate the wind direction, and if the streamers changed angle we knew we were off course. So we kept the streamers exactly as we found them from the time we took our bearings. When the cloud cover came, we would be well into the night voyage when navigation was harder. The only other navigational system we used when there were no star sightings was a long trailing rope which we would throw over the stern. If the canoe changed course left or right, we could tell by the angle of the rope to the canoe. We would keep that as our bearing, as well as the streamers, until we sighted a star formation. These were the only navigational tools we had (Whakataka-Brightwell 1994:8-9).

Non-stellar directional indicators also played an important role during this voyage. The rope 'trailer' dragging in the water behind Hawaiki-nui provided a simple means for corrections to be made if the canoe moved off course (Nelson 1991:18). Wind observations were also an important guide. Leaves of the 'aute' or paper-mulberry were tied to the rigging:

Maintaining the angle of the streamers in relation to the waka helped ensure an accurate course. Any change in wind direction was indicated by the streamers dipping and falling. Aute leaves bleach out to become florescent and therefore were used for night sailing as well. Streamers also indicate wind strength.

If the streamer angled downwards the wind was good - an even sail path. If the wind-streamer rose upward, level with the horizon, or straightened out the wind was strong enough to suspect big waves where two men would handle the steering paddle - rain, storms, waves, high winds. Then the worst instance, the wind-streamer would fall-dip-flutter-flap, canoe speed would slow, the waves take control rocking the canoe, sails fail, steering impossible, all hands watching the streamers for the wind change (Nelson 1991:18).

The voyage of the Hawaiki-nui is significant in many respects when compared with the other voyages of the modern Polynesian renaissance. Firstly, the Hawaiki-nui sailed unaccompanied, and was the only voyage from the 1960s-1990s period upon which an

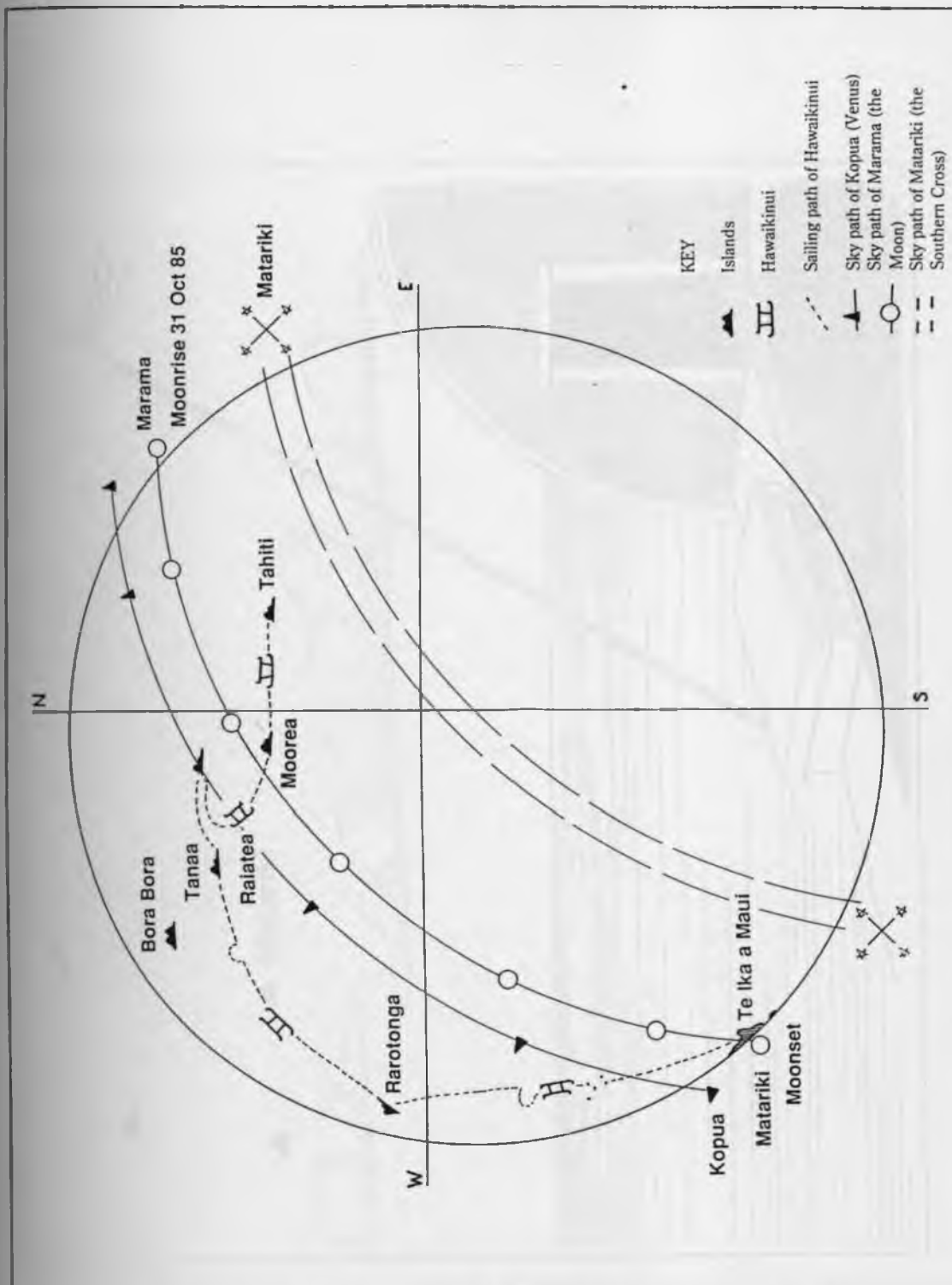


Figure 33: Star Navigation Chart showing *Hawaiki-nui* and Relative Star Positions (Nelson 1992:19).

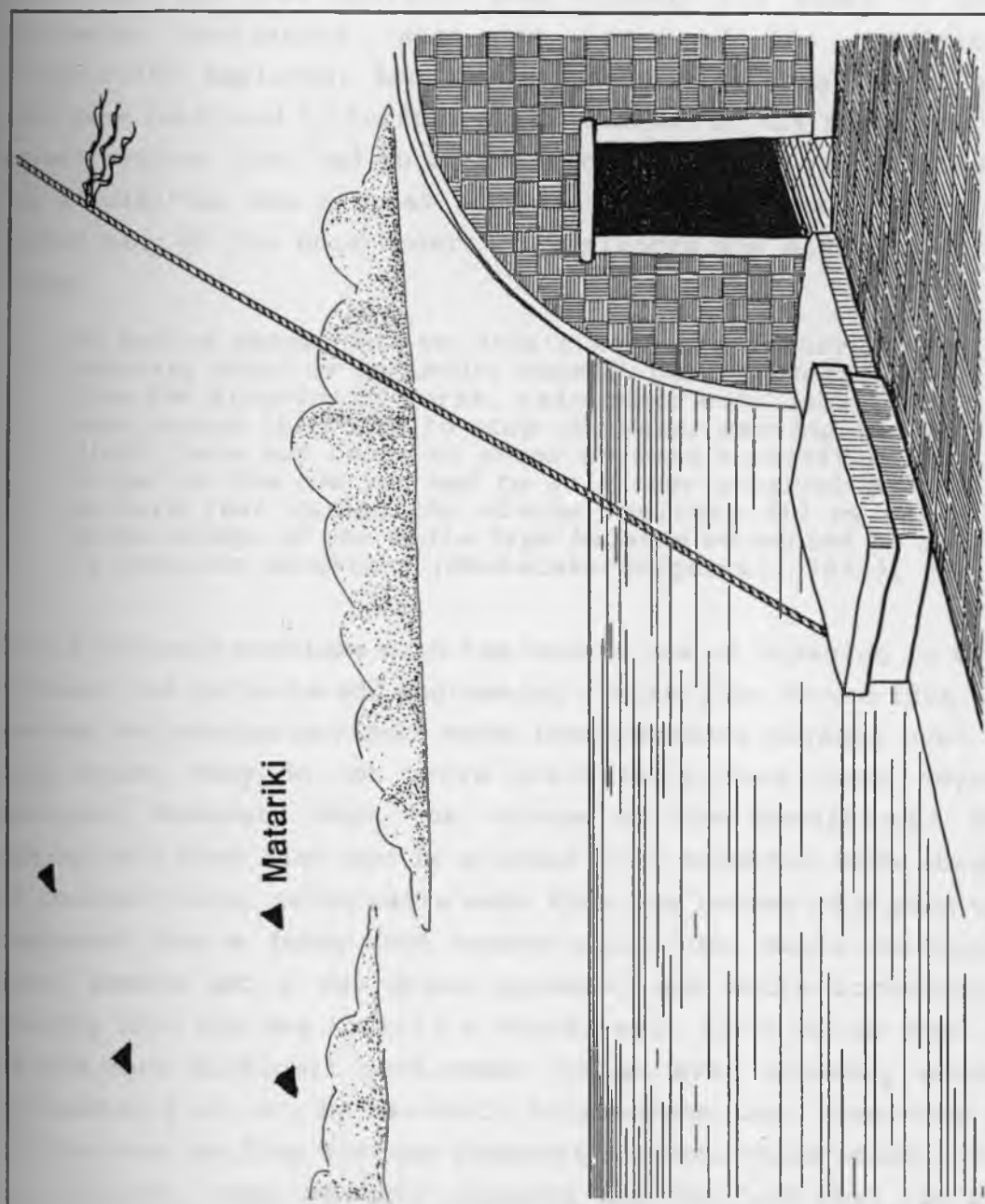


Figure 34: Sighting Matariki (Pleiades) (Nelson 1992:21).

independent safety check on the course was not kept. The canoe was also the only one constructed entirely from natural, and by all accounts historically accurate, materials.²⁰ Certainly this meant that the crew emulated more closely the feats of early Polynesian navigators. Also, in terms of the traditional construction employed, and the simple navigational techniques that were used, and in further consideration of the frequent, and severe weather that had to be endured during the voyage itself, the *Hawaiki-nui* was a great success. The fact that the venture lacked many of the more modern conveniences was also due to its budget:

We had no money, and we didn't have the luxury of an outboard motor or an escort vessel. Our raincoats were from the Ministry of Works, rain coats with insulating tape around the cuffs to stop the water getting in, we didn't have any boots or shoes or even a safety rail. To get to the bow you had to walk over a narrow plank in bare feet during the storms. Neither did we want those things or the media hype because we wanted to do it like our ancestors (Whakataka-Brightwell 1994).

One of the main problems with the modern era of voyaging is that, although the projects add increasing credibility to the idea that ancient Polynesian mariners made long extended voyages over the open ocean, they do not prove irrefutably that those voyages occurred. However, what the voyage of the *Hawaiki-nui* does demonstrate that five men in a canoe tied together with strands of coconut fibre, using sails made from the leaves of a palm tree suspended from a forty foot bamboo pole, can, while chewing on taro, kumara and a few green bananas, and while occasionally jumping into the sea to kill a shark, sail 1,600 miles over one of the most difficult settlement routes ever crossed, whether accidentally or not, by the early Polynesians. And, that they can do this when sailing through frequent storms, while using a rope in the water, some straggly pennants and the fact that the moon comes up from behind, as a means of knowing where they should be

²⁰ See Best (1925) *The Maori Canoe*, and Haddon & Hornell (1936) *Canoes of Oceania*, for a comparison with Whakataka-Brightwell (1994).

going. Whereas the other voyages had consistently proved the adequacy of the software of navigation, the *Hawaiki-nui* provided significantly increased proof about the long distance capability of the traditional hardware.

The feat that this voyage achieved, impressive in its simplicity, has several interesting implications. Firstly, given the difficulties faced during this voyage and the great distance covered, it would seem that long, deliberately navigated voyages were well within the technological limits of what was available to pre-historic Polynesians. Certainly the perception that traditional voyages were by definition difficult and highly risky affairs must be re-questioned. The time, effort, and labour, invested in this project, rather than the limitations of the technology itself, suggests that one of the main constraints on the occurrence of long distance Polynesian voyaging may well have been the investment and resources required to launch the venture rather than the difficulties faced while at sea. In pre-European times this may well have been the case, especially if the estimate of the return on the time, energy, and resources invested was low. This might have been the case with long distant voyages of discovery, or voyages to destinations about which little was known except the direction. Additionally, despite the success of *Hawaiki-nui*, we would also expect that longer distances did involve an increase in risk, however slight, and therefore probably engendered an added caution, unless of course a sufficiently good reason or benefit existed, which outweighed any perceived risk. Voyages of trade, expulsion, escape or colonisation might meet this requirement. Certainly the time and labour put into the *Hawaiki-nui* project would constitute a significant commitment for any pre-historic Polynesian community. The durability of traditional materials is another factor. Whakataka-Brightwell also reported that upon their arrival in New Zealand the ropes and halyards of the *Hawaiki-nui* had deteriorated significantly and were in need of replacement. What this means is that a long stopover of some months would have been required to refit her before a return could have been attempted.

Given these considerations we would expect that extremely long distance voyages of exploration, colonisation, trade and adventure over several hundreds, or upwards of 1,000 to 2,000 miles, were certainly possible although they may have been the exception rather than the rule.

Another pertinent point, in comparison with the other modern voyages, is that the frames of reference for navigation, although similarly based in principle, were in practice quite different. During the voyage of the *Rehu Moana* Lewis relied heavily on the sun and individual zenith stars for navigating. Thompson on the *Hokule'a* developed his own system of meridional pairs. On board the *Hawaiki-nui* greater use was made of the moon, stellar constellations and some planets. Lewis also used zenith stars for positional calculation whereas the emphasis that Whakataka-Brightwell and Cowan placed on the stars was more as determinants of direction. They also used the pennants and rope when utilising the currents and winds to maintain direction, whereas Lewis more often tried to 'read' the swell and wind patterns. What is significant here is that the range of indices, and the number of ways in which they can be utilised is quite large and varied. Again, this drastically reduces the perception that non-instrumental voyaging is by definition difficult. Certainly it seems that if one has the time and energy to learn, and comes to know what one is doing through reading the signposts of nature, then there is little reason to doubt that the feats of the *Hokule'a* and *Hawaikinui* could be replicated. In Whakataka's words:

We wanted to prove that the traditional knowledge of ocean-going canoes was not lost - that it was still known in Tahiti and New Zealand.

I would sit beside Hawaiki-nui next to my father's tipuna photograph, my mind, my spirit embraced in the beauty of our canoe - the hull adze cuts, the family-tree sculpture, the scent of the wood, the fibre rope lashings - searching the Maori horizon for a solution to ancestral landlessness, the lack of culture and language, the poor health and unemployment of my tribe (quoted in Nelson 1991:14-15).

It was a voyage full of pride and spirit.

CHAPTER EIGHT

TE AURERE

Following the inspirational success of the *Hokule'a* and *Hawaikinui*, another New Zealand venture began in 1990. The group was formalised as Te Tai Tokerau Tarai Waka Incorporated and sought to further emulate the accomplishments of the renaissance.

Construction

Hekenukumaingaiwi Puhipi, the tohunga tarai waka (canoe builder) of the new group, was formerly a bridge builder. In 1974 he was inspired by the sight of the newly constructed waka taua (war canoe) *Ngatokimatawhaorua*. This led him to build two war canoes named *Matatua*, and *Te Ika a Maui*. After the success of these projects, and that of the *Hawaikinui* and *Hokule'a* during the mid-1980s, he ventured to construct a double hulled ocean going canoe. The canoe, *Te Aurere*, was constructed on the banks of the river of the same name at Doubtless Bay in 1992 (Waka Huia 1993).

With the blessing of tribal elders two kauri logs were taken from the Herekino forest behind Pukepoto near Kaitaia (Puhipi 1993). From start to finish construction was completed in seven months. The fifty-seven foot hulls of the *Te Aurere* were scalloped as, according to the traditions of the Polynesians, were the hulls of ancient canoes. The scalloped grooves are thought to create a disruption in the flow of water past the hulls in a way which forms a layer of air bubbles between it and the canoe. This



Figure 35: *Te Aurere* Departing for Rarotonga in 1992.

serves to reduce resistance in much the same manner as the bulbous nose on a large modern tanker does (Conrad 1995; Puhipi 1995). As with other double-hulled canoes *Te Aurere* was fitted with a large steering paddle which acts in a similar manner to the keel on a modern yacht. It was further fitted with two smaller outside paddles called sweeps to aid steering and prevent leeway (Conrad 1995). The prows of *Te Aurere* were fitted with distinctive bow carvings made after two examples previously dug up in the Doubtless Bay area. The original carvings are thought to have been part of a very early canoe in the area and are now on exhibit in the Auckland Museum (Waka Huia 1993).

Upon completion *Te Aurere* and her future crew under went two months of trials before a planned voyage to the Sixth Polynesian Arts Festival in Rarotonga. Many of the crew for the voyage to Rarotonga received instruction from members of the Polynesian Voyaging Society in *Hawai'i*. In 1983 some of those associated with the *Hokule'a* visited New Zealand in preparation for their voyage there in 1985. Following this Stanley Conrad, later the captain of *Te Aurere*, accompanied the *Hokule'a* as a crew member on three legs of the 1985 to 1987 'Voyage of Rediscovery'. Several other members of the *Te Aurere* project received instruction and experience with the *Hawai'ians* during 1992 (Waka Huia 1993; Conrad 1995). Mau Piailug was also brought to Aotearoa and trained the crew over a period of two months, during which six short voyages were undertaken including one return between Waitangi and Doubtless Bay (Waka Huia 1993).

The final crew selected for the voyage comprised: Heke Puhipi and Stanley Conrad from *Te Tai Tokerau*, Mau Piailug as chief navigator, Kalai Bertleman from *Hawai'i*, Max Kalawaimai from Satawal, Craig Subritzky from *Te Aupouri*, Paul Le Noel from *Te Rarawa*, Phillip Evans from *Ngati Kahu*, Pakake Winiata from *Ngati Raukawa* and *Tuhoe*, *Te Atua Rangi* Clamp from *Ngati Porou*, Jack Thatcher from *Ngati Awa* and *Whanau a Apanui*, *Taituha Mamaku* from *Tuhoe* and *Ngati Awa*, *Wairongo Renata* from *Ngati Kahu*, and Sam Houwaho from *Tuhoe* (Waka Huia 1993).

Because of the short time frame within which the trials were conducted, the waka was subjected to other, sometimes severe tests. One month before the departure, the plugs were pulled out of its hulls in an attempt to sink the canoe in Doubtless Bay. Despite a full complement of sixteen crew on board, the water only reached about a foot below the level of the deck and no further. *Te Aurere* remained afloat. On another occasion *Te Aurere* was launched into the surf at low tide and fixed with a long sea anchor. The canoe was left to pound on the beach while the tide came in. The purpose of this was to ensure that the lashings and canoe are in sound shape. This test is now standard practice (Conrad 1995, Wilson 1995).

In its construction *Te Aurere* represents a cross between the *Hawaikinui* and *Hokule'a*. The hulls, spars, booms, crosspieces, and railings were wholly constructed from traditional materials as was the case of the *Hawaikinui*. In contrast, the lashings, rigging and sails were, like the *Hokule'a*, made from modern materials.

Aotearoa to Rarotonga 1992

The day before sailing the crew assembled at Waitangi and after a short ceremony greeted and fare-welled the modern war canoe *Ngatokimatawhaorua* with the hongiri (pressing of noses) in its storage house at Waitangi (Waka Huia 1993). *Te Aurere* departed on September 23rd. In respect of the occasion one elder was prompted to remark:

Today *Te Aurere* leaves. I have no doubts about their safe arrival. There has been a resurgence in the building of canoes which started with the building of *Matatua Two* here at *Aurere*. We now have the final product *Te Aurere*. It is a continuation of our traditions. The crew have mastered these traditions. They have built this canoe in the manner of our ancestors whose steps they now follow. They have the added safety of having a good guide on board. If my health were a little better I would gladly join them. I wouldn't be afraid of the sea, the pathway of our ancestors. They have the support of our Hawai'ian

brothers. They will also have the spirit of our forefathers guiding them to Rarotonga. If I were younger myself I too would go. I would not be troubled about following the path taken by my ancestors (Sam Snowden 1993).

The original sail plan was to head east for ten days and then head due north after picking up the predominant southeasterly trades. This was the course suggested by Nainoa Thompson during the Voyage of Rediscovery.²¹ As consistent with the concept of expanded island targets and island screens, the first priority was to strike for the Southern Cook Islands as a group. The second priority would then be to locate Rarotonga (Conrad 1995). In the inimitable words of Charlie Wilson 'the idea was to aim at the table first and then find the coffee maker' (1995).

After four days easting the crew noted that the weather was getting increasingly cold. They also thought that they had made more distance than anticipated. At that point it was decided to change course and head north. *Te Aurere* sailed straight into stormy weather. The first storm lasted twenty-eight hours and was intense enough that the escort yacht *Namsang* was forced to run before it, while *Te Aurere* rode it out. The storm was followed by two days of fine weather and then a longer period of more squalls running in from the west and northwest (Puhipi 1993; Conrad 1995; Wilson 1995).

Prior to the storms *Te Aurere* had made half the distance to Rarotonga in only seven days, and an early arrival was anticipated by some. However, the continuing stormy weather severely slowed further progress. One storm lasted four to five days with the total period of turbulent weather lasting fourteen days. At one time the crew considered heading for Tonga because of the continuing adverse winds. *Te Aurere* began running out of time to make her schedule. At one crucial moment the New Zealand Meteorological Office advised the *Namsang* to head north, away from further incoming bad weather from the south. Mau Piailug

²¹ See Chapter Six.

said that he thought a storm was forming in the north and that they should head more northwest. After some discussion a compromise was made and they headed north-northwest. They ran into the tail of the storm predicted by Mau. The information from the Meteorological Office had been wrong. The canoe was falling further behind schedule and after a discussion between the crew it was agreed that the canoe should be towed during calmer periods in order to arrive on time for the festival. Most of the crew agreed on the basis that the navigation continued to be directed from Te Aurere rather than the *Namsang*. *Te Aurere* was towed in this manner for about two and a half days. Then about two days after the tow was discontinued land was sighted. The canoe was again towed to hasten its arrival. Final landfall was made after twenty-five days at sea (Bersich 1995; Conrad 1995; Waka Huia 1993b; Winiata 1995).

During the voyage to Rarotonga Matariki (the Pleiades), Orion and Sirius were the main astronomical guides. For the first four days easting, Matariki was kept dead in front of the canoe, and, Orion and Sirius observed as relative guides. Once the heading had been changed northward then Matariki was kept on the front right hand side of the canoe (Conrad 1995).

The October 1992 Festival was marked by the gathering of several waka from Hawai'i, New Zealand, the Southern Cooks and the Marshall Islands. Most of the voyaging canoes gathered at Aitutaki and proceeded as a fleet to Rarotonga. The Polynesian Voyaging Society navigated the *Hokule'a* to Tahiti where a newly trained Rarotongan crew sailed it to the Cook Islands. However, some of the crews readied for the pageant were ill-prepared. The canoe from Atiu capsized on her first attempt to leave the island. It had to be towed back to the island and then righted. Its second attempt was more successful. The Mangaian canoe got lost for several days under overcast skies. Nonetheless, eventually they too found their way to Rarotonga (Lewis 1994:140-141).

The return to Aotearoa was made in early November with the canoe heading into the setting sun, with Scorpio low on the southwest horizon and dead ahead. The canoe left Rarotonga on November 9th and took eighteen days to make the return. Initially *Te Aurere* headed due west, and passed within one hundred miles of Tonga before heading south to New Zealand. Sailing was non-eventful until about eight days out from New Zealand when a severe storm struck a huge area of the Southern Pacific. For three days the canoe rode out waves up to forty feet high. The support boat had to run for shore in order to seek shelter. Several other yachts ran into trouble and *Te Aurere* broke its mast. Unfortunately the canoe had to be towed the last one hundred miles into Doubtless Bay after what was otherwise a successful voyage (Conrad 1995; Wilson 1995).

In respect of the power of storms Stanley Conrad commented that:

You had to have a sense of fear...you need fear to keep yourself alert. If you don't have fear then you begin to relax, and if you begin to relax you begin to give up, and if you begin to give up you won't make it,..... we ate uncooked noodles, wet wheetbix and drank cold water for three days during that storm. We looked forward to a hot meal (1995).

Summary

In respect of traditional methods of navigation utilised during the voyages Puhipi remarked that:

Generally navigation is not too difficult once the basic principles are understood, ka nui te marama. The most difficult part is landing (1993).

On *Te Aurere* the most important navigational calculations are considered to be distance and latitude. The estimation of longitude, as in the European system, is considered unnecessary. The calculation of latitude and daily distance covered is sufficient for making long voyages. Navigators gauge latitude primarily by astronomical means. They are then able to adjudge

their position more precisely by estimation of how far they have sailed each day. This of course allows them to estimate their position with reasonable accuracy, at any given latitude. For example if they voyaged across ten degrees of latitude in one week, that would be about 600 miles in distance. However, if they estimated that they had voyaged 700 miles during that week, then they would be able to work out that they were on a particular latitude within a span of about one hundred miles. Greater accuracy is achieved when additional distance covered by tacking is subtracted. Drift and leeway are also considered. Another important aim is to deliberately sail with a bias toward the windward or eastern side of the planned course and target. This compensates for any error because it provides a safety margin which can be made up by running with the predominant winds. It also means that an easier final run can be made to the target island. Sailing to the western side of an island can mean making several tacks into the trades; needlessly adding much time to an otherwise shorter leg (Conrad 1995; Wilson 1995).

In terms of stellar navigation, meridional pairs are used after the Hawai'ian example. The rising and setting positions of stars are also used. Zenith stars are used less frequently (Conrad 1995; Wilson 1995). It would appear that, although the New Zealand navigators were largely taught by the Hawai'ians, the use of meridional pairs is more suited to voyaging to and from Hawai'i, and Aotearoa, because their longer voyages tend to have to cross long stretches of latitude. Although zenith stars are more than adequate for latitudinal sailing, they are particularly useful along the equatorially situated islands of Micronesia, where that system is most used. The navigators on *Te Aurere* also adjust their star path calculations because of the tendency of stars in the Southern Hemisphere to arch northward when passing east to west (Conrad 1995; Wilson 1995).

The paths of the moon and sun are also exploited. Both are considered useful during the 'grey times' of dawn and dusk when star calculations are difficult because of the increasing or

diminishing light. Phases of the moon are also utilised. During the first and third quarters, the moon is usually visible between the hours of nine in the morning and six at night. This firstly allows it to be aligned with the stars and the sun, and in this manner provides a stellar guide during daylight hours. However, when using this system it is necessary to know at which point on the horizon the moon is rising and setting (Bersich 1995; Conrad 1995).

During daylight hours, and during bad weather, swell patterns are considered to be the most important indicator of direction. According to the crew of *Te Aurere* at least three different swells are usually observable at any one time during a voyage. The predominant swell, distinguishable as the main swell dominating the horizon, is used as the main directional reference. The relative angle at which it strikes the canoe is observed and constantly maintained. Any change in the heading of the canoe is detectable by change in the motion and pitch of the canoe which, in turn, is caused by an alteration in the angle at which the canoe is being struck by the predominant swell. Direction can then be readjusted by reorienting the canoe, according to previous angle at which it was sailing, relative to the predominant swell. The crew of *Te Aurere* state that Mau Piailug was able to detect even subtle changes in motion and pitch by feel, even when asleep in his quarters. Wind direction is also used in a similar manner. Any change in the direction of the wind is observable through changes in the direction of streamers attached to the shrouds. Importantly, they also note, that any major change in wind direction does not result in a corresponding change of the predominant swell pattern until two days later. Therefore any change in wind direction can be noted as such because of the greater consistency in the direction of the swell (Bersich 1995; Conrad 1995; Wilson 1995).

Te Aurere left New Zealand with the desire to be in Rarotonga by mid-October. However, its late September departure meant that cold and stormy seas running in from the west were still

predominant. This resulted in the canoe being pummelled. Because of the need to keep to the deadline *Te Aurere* was towed during calmer patches. Unfortunately, as a result of the towing incidents, the voyage has been over-criticised as not being truly representative of earlier pre-European navigation. However, despite the towing, the voyage indicates clearly enough that under more benign conditions such a trip could probably be made (Finney 1994:67-68). It is also important to note that *Te Aurere* was only towed during calmer weather and that the waka was more competent in adverse weather than its modern companion the *Namsang*. *Te Aurere* was also the first Polynesian voyaging canoe to ever have had an appointment. Time was of the essence.

Another lesson learned from the voyage to Rarotonga was that once a sail plan was set then it should be adhered to. The crew of that voyage now agree that part of the reason they ran into so much stormy weather was that their decision to turn north was premature (Wilson 1995).

Generally speaking, the experience of the *Te Aurere* added testimony to the credibility of the seaworthiness of double-hulled Polynesian canoes. During both the voyage to Rarotonga and the return *Te Aurere* handled the rougher weather better than her escort yacht the *Namsang*. Among the Polynesian voyaging community that kind of performance is now accepted as standard. This kind of efficiency is attributable to some of the characteristics inherent in the design of double-hulled Polynesian canoes. Firstly, the wide bodied nature of the canoe gives it more stability. This allows double-hulled canoes to heave to and ride out most bad weather. Plugs in the hulls can be pulled out to add more ballast which helps to prevent capsizing. Conventional modern single-hulled yachts are required to run before storms because they face a high risk of broaching and capsizing if at any other angle to the weather. Another advantageous characteristic of Polynesian double-hulled canoes is that they are lashed together rather than moulded or nailed. This allows them to flex under the duress of heavy seas and winds which in

turn absorbs a significant amount of shock from heavy seas and strong winds. *Te Aurere* was also constructed from logs which made it virtually impossible to sink as shown during the 1992 pre-voyage trials (Conrad 1995; Wilson 1995).

One inclusion of equipment following the 1992 voyage has been the introduction of a satellite navigation capability for teaching purposes. During trails and voyages one crew member monitors the course while navigators hone their skills. Once back on shore a comparison is made and corrections and improvements to methods either advised or complimented (Wilson 1995).

Another modification was the dispensing of the paddle sweeps which were prone to being driven and broken against the hulls of the canoe. These were replaced with lee-boards which are lowered through slots in the deck into the sea. These work more effectively than sweeps to reduce leeway. They are inserted on the inside of the hull opposite to the direction of tacking. A second mizzen mast and Polynesian crab claw sails have also been added. Originally the masts were fitted with conventional teardrop style sails. These were found to be less efficient than crab claw sails at collecting wind when sailing through troughs (Conrad 1995).

Prologue

Beginning in May 1995 a fleet of canoes will depart Tahiti for Hawai'i. The canoes will sail through Teavamo'a, a sacred pass in the reef to the beach at Taputapuatea, home of the god Lono, traditional school for navigators. One belief is that Taputapuatea was a gathering point for canoes from all over Polynesia. The last such gathering is said to have been the *Pai Atua* when the canoes were dragged up on the beach over the bodies of live sacrifice victims. It is said that a Maori *tohunga* was killed there and a curse left in retribution so that the place could never be used as a gathering place ever again. It is



Figure 36: *Te Aurere* Being Prepared for the 1995 Voyage from Tahiti to Hawai'i.

intended that the curse be lifted by the *Te Aurere* from New Zealand when it is the first of the fleet to pass through the reef. The 1995 fleet will consist of the *Hokule'a*, and the new waka *Hawai'iloa*, both from Hawai'i. The *Hawai'iloa* has been constructed from logs cut in Alaska and is fifty-seven feet long. The navigators are Chad Babayan and Bruce Blankenfeld. Both will be overseen by Nainoa Thompson and Mau Pialug. From Rarotonga is the *Takitumu* at sixty feet, and *Teau O Tonga* at seventy-two feet long. These will be navigated by Tua Pittman and Peia Tua'ati. The *Takitumu* has already sailed to Tahiti. Both Rarotongan canoes were designed by Sir Thomas Davis, built with wood planking, and lateen rigged like Fijian *ndruas*. From Tahiti is the *A'a Kahikinui* which was constructed from breadfruit trees and is forty feet long. It was built by Kareem Cowan who is also a navigator. The *Hawaikinui* has been overhauled and will also sail. Both have crab claw sails (Krauss 1995:1-3).

In preparation for this voyage *Te Aurere* completed a 2,370 mile circumnavigation of *Te Ika a Maui* (the North Island of Aotearoa), between November 1993 and February 1994. Significantly many of the experienced crew who undertook that voyage remarked how much more difficult coastal sailing was compared with deep ocean voyaging. One close encounter occurred off the East Coast when the crew could hear waves crashing over unseen rocks only a few metres away in the middle of the night. In another incident, the canoe was hit by a sudden twelve to fifteen foot swell while off the Kaipara harbour entrance. When entering Kawhia under tow four men were required to hold the steering paddle in order to keep the canoe in line with the towing vessel. At the time of writing new crews were being selected and the canoe prepared for its latest challenge (Conrad 1995; Wilson 1995).

The proposed venture is part of a new phase in Polynesian voyaging where an increased number of canoes are being constructed, and a greater number of island communities are becoming involved. Many of the earlier experimental voyages, with their tentative beginnings and inevitable errors, are now

approached with some confidence. No doubt this confidence is attributable to the successful experiences of the last twenty years. However, it is also, in no small way, due to a new sense of pride, dignity and self-esteem gained from the replication, of the deeds of long lost ancestors, upon the migratory pathways of the ocean Pacific.

PART THREE

POLYNESIAN ORAL TRADITION

POLYNESIAN ORAL TRADITION

CHAPTER NINE

ISSUES IN POLYNESIAN ORALITY

Before examining Polynesian oral tradition, it is necessary to consider several issues including the distinction between myth and tradition, reconstructionism and the minimalist view, and the reliability of genealogy as history. Historically there have been two positions in regard to Polynesian tradition. The minimalist view regards oral literature as a special sort of fiction, which functions to fulfil the emotional and spiritual needs of illiterate peoples. The traditionalist view is more willing to accept oral tradition as history. Unfortunately, at its extreme, it has tended to accept as fact almost anything purporting to be genuine oral tradition. This latter position has spawned several, quite dubious, new 'histories' including the infamous 1350AD 'fleet' to New Zealand.

Genealogical Recital

Polynesian oral tradition is characterised by narrative prose, forms of poetry, and genealogical recital. It makes extensive use of synonyms, contrastive opposites, and the repetition of words and phrases.²² Genealogical recital embraces a time scale incorporating both myth and tradition in a comprehensive paradigm of reality. The mythology is set in the far distant past and

²² In contrast to English poetry there is an absence of rhyme or assonance (Biggs 1966:447).

contains a large element of the marvellous. It includes explanations and precedents for the elaboration of culture, the origins of social institutions, customary practice and social behaviour. The major mythological cycles are widely known throughout Polynesia (Biggs 1966:447-448; Walker 1976:19-20; 1993:10-15).

At the first level these cycles begin with the creation of the universe, the world, the gods, and all phenomenological existence including all life, the seas, clouds, stars, rocks, weather, moon, forests, and all other things therein. The order of creation and natural phenomena are personified and arranged in a genealogical form (Best 1924:55-133; Hiroa 1932:20; 1932b:15; Biggs 1966:448).

The second level of mythology contains the pan-Polynesian stories concerning semi-human demi-gods such as Maui and Tawhaki who, endowed with supernatural powers, act out various dramas in an age of supra-normal events. These stories reflect the philosophy, ideals and norms of the people, and are projections of current social practices back to a mythical time and place. They also form a genealogical link between mythology and tradition. Thus the gods are the source of knowledge and the demi-gods of this echelon, intermediaries who transmit it to human kind (Gifford 1924:139-152; 181-195; Beckwith 1970:226-275; Best 1982:329-377, 423-447; Walker 1976:20; 1993:10, 15). At this level other names can also be interpolated in the genealogy. They are often composed of variable lists of names descriptive of the sexual act, or alternatively series of place names and are descriptive of past unknown generations, places and time (Scarr 1992:55-60; Walker 1993:Appendix 7).

The traditions follow on from the myths and can also be divided into two parts. Firstly, there are those concerning the discovery, exploration, and migration to new lands. This phase usually includes the names of progenitors who came from other lands, the names of canoes, crew and anything of note that may

have been brought. Migration traditions are fullest in East Polynesia and indicate much long distance voyaging between twenty-five and thirty generations before 1900 (Smith 1904:79-82; Stokes 1930:1-2; Robertson 1958:39; Biggs 1966:451).

Nearly all islands have their legendary founders, Kaitu'u in Rennell, Tefolaha for Nanumea in Tuvalu, Hotumatua in Easter Island, and Kupe in New Zealand. Stories pertaining to migration and settlement tend to be more numerous than those about first discovery (Biggs 1966:451). In many cases the genealogies of descent from migration to the present are internally consistent. In other cases they are fragmentary and discontinuous (Hiroa 1932:20; 1932b:15). Te Hiroa writes:

The Polynesian traditions, with few exceptions, trace their descent back to seafaring ancestors who came from elsewhere in voyaging canoes, the names of which are remembered with pride....The theme of islands being fished up out of the ocean depths by gods or heroes is widely spread and may be a mytho-poetic pattern derived from some early deified ancestor, who, by discovery, fished the islands out of the sea of the unknown.....The traditional narratives contain frequent references to voyages toward the rising sun, and myths state that after death the spirit of man turns toward the setting sun to retrace the long journey to the ancient homeland in the west (1945:10).

Secondly, there are the local traditions pertaining to the proliferation of tribes and subtribes after initial settlement. The recital of these traditions validated claims to land, gave authority to those of rank, and defined external political relations (Biggs 1966:450). In addition to this, the traditions reviewed in the following chapters are consistent in that they describe frequent voyaging within their own island groups over a few hundred miles, and less frequent voyaging beyond the boundaries of their groups, often over several hundreds of miles.

Biggs (1966:448) and Walker (1993:15) make a clear distinction between myth and tradition on the basis that 'history' begins with the latter. It may however be, that some of the mythological demi-gods are deified ancestors (Stair 1896:34-57). On this point it is possible to find parallels within several European

mythologies. For example, the first tales of Robin Hood were written in the 1370s and were based on a real 'highway robber' operating near Barnsdale during the reign of Edward I. 'King Arthur' contracts to a Celtic war chief killed fighting the Saxons in 510AD. The Iliad and Odyssey, which were written down 500 years after the real events they describe, were previously transmitted orally. These legends incorporate elements of both the fantastic and historical (Scarr 1990:56). Given that the stories in Polynesian mythology remained unwritten for a greater passage of time than these European legends, it is more likely that they came to include more of the fantastic. However, this does not make them fiction. Certainly myth and tradition overlap. In the early part of the 'traditions', regarded as history by Walker and Biggs, the actors are no doubt real people, but being remote enough in time they are often also endowed with supernatural powers (Best 1982:202-203; Walker 1976:29; Scarr 1990:52-54, 56-57). The presence of myth does not preclude the possibility of history. Therefore, although Robertson (1958:39) is correct, that at some stage there is a transition from pure myth, through myth plus history, to pure history, the delineation between fact and fiction is perhaps not as distinct as Walker and Biggs attest it to be. It is likely that the mythical parts became formalised as more recent historical records evolved. However, until more work is done it will remain difficult to discern clearly whether some elements of the myths are indeed history. Nevertheless, Biggs' and Walker's definitions are questionable.

It is also difficult to circumscribe tradition and mythology when stories of the land being fished out of the sea by semi-mythical entities such as Maui, and visited by others such as Rata, are confused with the narratives of first human occupation. Further complications occur when the genesis of human beings is located within the proximity of the island occupied. This seems to be part of two conjoint processes whereby the need to explain the origins of the human race and the land is localised for whatever reason, and recorded orally alongside whatever remains of the

first or most remembered arrival by canoe (Monberg 1966:85-91).

The Reconstruction of Tradition

Before modern archaeology oral traditions were one of the main guides for reconstructing the history of Polynesia. Several Europeans used information from indigenous informants to construct composite paradigms based on their own interpretations (Mead 1975:182; Finney 1977:70-71). In 1854 George Grey published his Polynesian Mythology, the first collection of Maori tradition to be printed. Later Abraham Fornander (1878, 1880) and Smith (1898, 1904, 1910, 1913, 1914), the foremost traditionalist of the nineteenth and early twentieth centuries, promoted the now discredited paradigm of a Polynesian migration, from India across the Pacific, culminating in the arrival of a 'fleet' in New Zealand in 1350AD. Smith believed all oral tradition to be ultimately based on fact, and that it only required to be reinterpreted correctly, by him. He also readily accepted all genealogies as fact, including the mythological, with little scrutiny (Howard 1967:59-60).

These reconstructions were widely accepted. However, they are now largely discredited. In 1926 Hare Hongi wrote:

The most audacious of these fabrications is that which was recited to Sir George Grey, and which is published in his Polynesian Mythology (p83). The story purports to give a detailed account of the setting out of seven canoes from some unknown island in the Central Pacific to New Zealand. It is manifestly self-glorificatory, but, apart entirely from that, it is a historical necessity to show how false it is...(cited in Sharp 1959:13).

Later critics pointed out how Smith and Fornander had patched together their settlement schemes from disparate legends:

To erect their elaborate migrational histories, they and other amateur scholars of their time committed a number of scholarly sins - the uncritical acceptance of oral traditions that incorporated modern geographical knowledge and biblical themes, the combining of separate tribal legends to develop a

coherent history, and the unsystematic comparison of isolated words across a wide range of languages (Finney 1991:I:18).²³

The reconstructionists also exaggerated the swiftness with which the Polynesians crossed the Pacific. It was declared that the Polynesians 'traversed the vast expanse of the Pacific as western peoples explored a lake' (Best 1924:6).

Much of the material used by the revisionists had already been altered by indigenous scribes. These changes are easier to show in the Polynesian mythological cosmogonies than among the traditions. A study of chants recorded during the early 1800s in the Society Islands reveals that Ta'aroa, the god of the sea, was elevated from his original place as one of several gods to that of supreme god, deliberately fashioned after the Christian god. Another omnipotent Tahitian god called 'Jhoiho' has also been proven as a post-European construct. This occurred within fifty years of European contact, and within twenty years of active missionary input (Emory 1938:52; Barrere 1967:104-105). The rate of change depended not on the date of contact but rather the extent of that contact, the key factor being the establishment of Christianity (Hiroa 1945:66).

In New Zealand 'Io', an entirely new character was created, and headed a cosmogony as the creator of all things. Whiro was transposed as the devil and concepts of heaven and hell also introduced. The 'Io' cult spread rapidly throughout the country during the mid to late 1800s (Hiroa 1949:435, 535-536; Barrere 1967:108). 'Noa' was introduced as the father of Tawhaki's father Hema in an attempt to align the tradition with Noah and Shem. Tawhaki was seen as the Christ because of his ascent to 'Rehua' (Simmons 1976:10).

In 1920 a group of Hawai'ian visitors to New Zealand conveyed the 'Io' concept back to Hawai'i where it was associated with the

²³ See also Barrere 1969; Sorrenson 1979; Simmons 1976; Simmons and Biggs 1970.

hawk (io) and the god Uli. Later the introduction was discredited as an import, containing too much of the Maori cult (Emory 1942:202-203). Other Hawai'ians such as Kepelino and Kamakau composed creation stories based on Genesis. A twenty-two generation biblicised genealogy was fashioned descending from 'Kumuhonua' a figure based on Adam, and a new 'trinity' introduced based on Ku, Kane and Lono. All this received favour from Fornander (1878) who wished to prove his theory of Semitic origins. They also introduced 'Hawai'iloa' as the discoverer of Hawai'i and 'Kalani Menehune' as Isaac (Barrere 1967:108-111). The adoption of monogenesis and descent from Adam and Eve was impelled by the desire to link sequentially with Biblical origins (Sorrenson 1977:453-455). These Hawai'ian modifications paralleled the rise of Mormonist theories in the United States. Christian teaching reached the Tuamotus by 1817 and by 1859 Ta'aroa had become the 'Prince of Darkness, and either Papa or Wakea the 'god of light' or supreme being. Another trinity of 'father, son and spirit' was also introduced. This was followed by the revelation of Kiho, another supreme being in 1929 (Barrere 1967:112-117; Emory 1939:19-20; 1947:6). In the Tuamotus also, a comparison of early recorded chants and genealogies with those recorded some time after Christian contact, reveal how pre-European concepts have been overlaid and obscured by efforts to bring ancient lore in line with Biblical teachings (Emory 1940:69).

In the writer's view it is likely that the selective inclusion of European ideas into Polynesian cosmogonies is partly attributable to an inherent process within oral tradition whereby new ideas are adopted and integrated into established lore. It is also likely part of a response which justified the incorporation and reformation of the new Polynesian religious elite within the Church, and conversion to Christianity. Dialectically, it was also a reaction against intellectual and spiritual hegemony. In the latter sense it was probably also a reaffirmation of identity.

In regard to the traditions, Fornander used mainly Hawai'ian genealogies, whereas Smith used mostly southern Polynesian material from Tahiti, New Zealand and Rarotonga (Stokes 1930:1-2; Sorrenson 1977:448). These traditions were already substantially altered. Rarotonga was an early training centre for missionaries, many of whom were Rarotongan, and who later travelled about the Pacific gathering material which was later collated and included in manuscripts such as that by Te Arikitetaraare. He later became one of Smith's main informants. Te Ariki's genealogies are themselves inconsistent. In one, Uiterangiora is in the thirty-fourth generation, and in another forty-fourth (Stokes 1930:34). In fact from 1770 onwards thousands of Polynesians were moving around the islands on European vessels. For example, there is ample evidence of post-European contact between Samoa and Rarotonga. One Rarotongan, hearing of the Chief Malietoa in Samoa, changed his name to Malie and went there claiming kinship with the chief. Another 1890s Rarotongan informant even remembered stories about preserved moa being brought back to Rarotonga. He also remembered that New Zealand had been called Aotearoa. In 1897 Smith met Tamarua a man who claimed to know of a fleet which purportedly departed Rarotonga and included the canoes, *Te Arava*, *Kuraupo*, *Matatua*, *Tokomaru*, *Tainui* and *Takitumu* (Sorrenson 1979:45-46). Evidence suggests that this information was elicited as a response to leading questions (Hiroa 1945:31). Another Rarotongan story is that Tangi'ia visited 'Rapanui' or Easter Island. However, the name 'Rapanui' is now known to be of post-contact Tahitian origin. Similar late incorporation of the names of 'Pangopango' and 'Hamo'a', unknown in the older material, occurred in the traditions of New Zealand (Sharp 1956:77-84).

During the latter part of the nineteenth century ancient genealogies were rearranged and interpolated with new names to biblicalise the traditions of the Hawai'ian people (Howard 1967:89). 'Hawai'iloa', already mentioned, was invented by Kamakau and Kepelino. Another version collected by Fornander contains the characters of Nu'u and Luanuu as Noah and Abraham (Fornander 1878:101; Stokes 1930:26). Kamakau was a reformed

Protestant who wrote his material between 1866 and 1871 in an attempt to prove that Catholicism and traditional Hawai'ian religion were identical (Stokes 1930:26).

In New Zealand the popular Matorohanga/Whatahoro derived fleet traditions have been shown to be unreliable on the grounds of the introduction of European knowledge, plagiarism from other traditions, romantic fabrication, and the invention of genealogies which fail to support the narrative (Robertson 1958:250; 1969:253-254; Hiroa 1949:41, 48, 58; Simmons 1976:315-321; Sorrenson 1979:55-57). Smith became convinced of his theory upon reading the Whatahoro manuscript. He reconciled several contradictory genealogies for Kupe simply by saying there were two. In doing so he brushed aside all inconsistencies, and accepted what he wanted to believe. Similarly he also argued that there were two Tokomaru. Later, his theories were heavily criticised on the basis that they indicated a too detailed knowledge of things going on in Hawaiki. Smith, himself acknowledged that much must have been added by either Whatahoro or Te Matorohanga, the scribe he purported to quote. He also pointed out that some stories such as those concerned with the *Takitumu* appeared to have biblical analogies added to them (Sorrenson 1979:45-47, 51).

This writer also notes that the Maori, Hawai'ian and Rarotongan distortions all claim legitimacy in the learned lore of old, either through the quotes of some supposed high priest or through the existence of some genuine and old manuscript. Usually the label of 'tapu' or sacred was added for authenticity and to avoid awkward questions. The indigenously altered material also tends to parallel whatever European theories of origin were being promoted at the time.²⁴ As Orbell (1985:2-3) noted, the traditions changed so fast after contact that it is now essential to work with those collected during the earlier years of contact. The number of traditions which contain the names of recognisable

²⁴ See Chapter One for a summary of those theories.

homelands, and which were recorded early enough to be considered reasonably free of derived European knowledge are probably few in number. Sharp (1956:74, 80) suggests 1850 as a benchmark date for being free of European influence. The extensive collections of Grey, Fornander, Smith and others were all secured after 1845. Other problems abound. Grey (1854:x) noted that the 'old-time chiefs and priests' were a fast vanishing race. No doubt much was lost. The current writer believes that most traditions probably began changing within twenty years of Christian contact.

Another common fault was the misinterpretation of tradition. In the West Polynesian groups of Samoa, Tonga, and Fiji the name of the spiritual abode to which spirits returned was Bulutu.²⁵ Fornander (1878:VI:19) connected this name with Buru in Moluccas. Others suggested a connection with Beru or Peru in the Gilbert Islands. Sharp (1956:74-76) criticised this conclusion as an assumption and pointed out that Bulutu was regarded as the spiritual destination of departed spirits rather than a land of origin. In East Polynesia, Hawai'i and New Zealand Hawaiki is a traditional name for a homeland and is often associated with Savai'i in Samoa.²⁶ Fornander associated this name with 'little' Java, and from there to 'Saba' in Arabia (Fornander 1878:22-25). However, in Samoa Savai'i is said to be named after a person of the same name (Sharp 1956:76-77, 80). Hawaiki is also a spiritual name and therefore using it to pinpoint a homeland is usually arbitrary and superficial (Orbell 1975:344). Sharp (1956:77-84) argued that the names Rangiatea, Kuporu, Waerota and Nukuroa which appear in New Zealand traditions are probably more genuine because the islands or places are unspecified. He also insinuated that the transference of names could have occurred as the result of accidental voyage. Whether he is right or wrong about accidental voyaging is not the point. The point is that an association of names is not necessarily proof of any kind of

²⁵ Other variations include Pulutu, Belotu, and Burattu (Sharp 1956:75).

²⁶ Other variations include: Avaiki, Hawaii, Heawie, Heavai, Owaii, Heawiye, Oheavai (Sharp 1956:75).

deliberate voyaging.²⁷

In respect of another consideration, one danger that indigenous peoples face if they adhere to altered material is that the wider body of traditions loses credibility and comes to be viewed as:

...little more than tall stories which are irrelevant to those with a serious concern for the facts. It is important to go behind the 'body of reinterpretation and censored, retold stories' in order to approach 'the original accounts in their entirety, and in their own terms, and in their proper context' (Orbell 1975:341-342).

The Minimalist View of Tradition

An early critic of the value of Polynesian oral history was William Colenso (1868) who wrote with reference to the traditions of the Maori that:

The names of several canoes are given, also of their crews or leaders; their marvellous adventures by the way; the numerous things they brought to New Zealand; and the height of the men 9 and 11 feet. Also, that some of them had previously discovered New Zealand, in a voyage of exploration purposely made hither, and having coasted and visited different parts of it, had returned to the mother country and had been the means of others coming to New Zealand to settle; and that many of the canoes, on reaching the land of New Zealand, immediately set about circumnavigating the Northern Island, &c., &c., In all this mythical rhapsody there is scarcely a grain of truth; and yet some educated Europeans have wholly believed it (cited in Sharp 1959:68).

A great deal of the early criticism of the validity of oral traditions as history stemmed from the ethnocentric belief in the superiority of European culture. European missionaries disparaged Maori beliefs as puerile, and as 'works of the devil' (Biggs

²⁷ There are traditions of accidental drift voyages in New Zealand, Naasau, Pukapuka, Tubuai, Raivavae, Rarotonga, Tahiti, and the Tuvalu and Tokelau islands (Denning 1963:128-129; Beaglehole 1938:393, 378; 1955:245; Morrison 1789:135; Aitken 1930:6; Ellis 1829:51; Corney 1915:255; Sharp 1956:73-74).

1966:447; Hiroa 1926:182).

In another reaction modern archaeologists, partly in rejection of Fornander, Smith, and Best, have tended to over-minimise the historical merit of traditional material. For example, regional variations in culture among the Maori have been explained as part of an internal adaptive process rather than having been the result of separate migrations of people from overseas. A 'law of least moves' has been invoked whereby only a very few canoes ever reached Aotearoa (Finney 1994:71-72; McClone et al 1994:137).

This position is supported by Simmons (1976) who theorised, on the basis of an extensive study of traditional material, that the migration legends of the Maori referred to relatively recent internal movements of population and not to voyages from overseas. More recently Orbell argued that 'authentic' Maori canoe traditions were not 'historical' but instead were poetic, religious accounts of origin composed to reinforce tribal identity, and make the world more meaningful. She acknowledged the possibility of some historical truth but argued that it would be difficult to separate those elements from the purely mythological. She also suggested that some of the legends may have transferred from islands in the Pacific and pointed out the similarity between the story of Kupe in New Zealand and that of Tupa in the Marquesas (1985:i-ii, 29, 66).²⁸

Robertson (1958:39-40; 1969:253) wrote that academic anthropologists have often criticised oral tradition without fully understanding it. Hiroa (1926:181) added that Europeans, having a longer tradition of literacy, tend to underestimate the memory ability of non-literate peoples. On the one hand they are sceptical about memorised tradition, and on the other they show a ready acceptance of unverified printed material.

²⁸ Unfortunately, Orbell's reference for that particular comparison relies on a direct quote from Sharp (1956) rather than her own research. Sharp's selective use of evidence was questioned in Chapter Two.

Consistency in Tradition

Despite the aforementioned concerns Polynesian oral tradition frequently shows a high degree of consistency. This is especially noticeable between disparate groups and is not purely coincidental (Robertson 1958:43, 53; 1959:293). Polynesian traditions concerning the origin of island settlement are often reliable (Suggs 1960:771-772). A general consistency is evident among several islands and genealogies in East Polynesia, and also among several tribal groups in New Zealand as shown by the monument depicting the descent of Mahuta from seven canoes at Morrinsville (Robertson 1957:251-253). Adkin commented that:

Polynesian and Maori traditions down to European times reached a high plane of primitive integrity and continuity, and was probably unsurpassed in any other part of the non-literate world (Adkin 1960:229).

In recent times Kirch and Yen (1982) in Tikopia, and Garanger (1972) in Vanuatu, found a high degree of correlation between oral traditions about the arrival and cultural impact of voyagers from other islands, and the archaeological record (Finney 1994:73). McFadgen (1994:195) notes the coincidence between Maori genealogies and radiocarbon dating in New Zealand. The agreement is remarkable considering problematic interpretations of oral traditions and the standard errors and secular corrections that need to be applied to radiocarbon dates. Sutton (1994:255) commented that several papers from The 1987 Symposium on the Settlement of New Zealand contained positive comments on the degree to which Maori traditions confirm or corroborate archaeological findings. However, there is still considerable uncertainty amongst academics as to how oral tradition should be treated. Any comparative evaluation between archaeology and tradition must be based on a high level of intellectual integrity and work before either can be integrated. The failure of earlier attempts has been largely due to insufficient and superficial analysis (Golson 1960:380-402).

There are also clear limits to its continuity. According to Robertson (1969:253) the Maori East Coast and the Bay of Plenty traditions are reliable back to at least the sixteenth century, and Tainui and Te Arawa further. The Taranaki traditions are only reliable back to the seventeenth century. Other genealogies may show consistency back beyond the accompanying narrative.

A distinction can be made between authentic pre-European tradition and the popular concepts currently held by some Polynesians. Authentic tradition was preserved by duly selected and trained specialists taught in special schools of learning. The emphasis was on learning according to rigid standards of memorisation, the intact extent of which is, to some degree, the historical equivalent of the documentary written record (Hiroa 1926:183-187; Robertson 1957:258; 1959:293). One impressive example of the retention of genealogy is that given by Tamarau Waiari who on one occasion in the mid-1890s recited 1,400 names from memory, in a descending, pyramid shaped, lattice of interlocking genealogy from one ancestor about 800 years ago. His recital included all the then living persons of Ngati Koura of Tuhoe (Hiroa 1926:183; Biggs 1969:6). Recitals such as these constitute a more than adequate chronology because of the high degree of consistency of hundreds of interlocking individuals. Simply put, past authentic tradition is relatively consistent, and conversely what is not consistent is not authentic (Robertson 1958:41-42).

Historically Valid Tradition

In terms of their historical validity, Polynesian genealogical matrices can be reliable from between fifteen to thirty-five generations before 1900, or for less than 1,000 years. However, above fifteen to twenty generations the possibility of an internally consistent, triangular, genealogical matrix becomes much smaller, and the number of errors and variations more frequent. Beyond that the incompleteness of the record, its

inconsistency and often contradictory nature make its reliability less tenable but not impossible (Best 1925:5; Biggs 1969:10-11; Walker 1976:29; 1993:15). Distance in time and the size of the population also corresponds with how much is remembered accurately. For smaller islands with lesser populations, such as Anuta and Kapingamarangi, the genealogies are shorter being up to about ten generations before 1900. Among larger populations such as in New Zealand, Tonga, Rarotonga and Tahiti, reasonably reliable genealogies are found up to twenty-five, and perhaps up to thirty-five generations before 1900. This pattern seems to be consistent throughout Polynesia and is probably a good indication of the limit and extent of historical retention in an oral culture, other than through mythological means.

Some lines, such as those from Tonga, extend up to forty generations before 1900. These are usually based on singular royal lines of succession which in the earlier generations, because of a lack of the retention of information regarding genealogical contemporaries, have no interlocking matrix. Triangular family pedigrees are more reliable than lists of singular rulers or title holders because the tenure of office is generally much more variable than the duration of life (Hiroa 1934:26). Precise validation is therefore difficult, although reasonable approximations are possible.

Similarly in New Zealand and Rarotonga names such as Kupe and Kahukura appear in some genealogies up to fifty generations before 1900. These are likely broken lines of descent. These earlier genealogies have philosophical and incantational value. They serve to retain and instil ancestral 'mana', but tend not to keep the descent lines pure (Stokes 1930:5). The validation of these longer lines is also difficult because Polynesian orality incorporated the use of truncated genealogies containing selective lists of luminaries. These could be lengthened or shortened, and applied across the entire framework of the genealogies from the creation downward. Time was foreshortened by the telescoping of a series of complex events, occurring over

several generations, into one well remembered, heroic figure or episode (Scarr 1990:59-60; Walker 1993:15).²⁹

The traditions also include, somewhat characteristically, a five to ten generation, almost singular, line of descent from first settlement. The names of those from significant marriages are recorded although the genealogical matrix is usually narrow rather than broad. Once settlement is established and permanent corporate groups ensconced, the genealogical matrix tends to rapidly increase.

All significant attempts to reconcile the Polynesian traditions beyond about twenty generations, including the major fabrications discussed earlier, have failed. Some names appear in common among many genealogies, and often in sequence. However, this is usually in the area bordering myth and tradition and no one as yet has successfully unravelled them completely (Biggs 1969:14-15).

In respect of another issue, and for the purpose of this thesis, an attempt has been made to provide a simple non-problematic method of dating genealogy. Smith attributed twenty five years per generation and Fornander thirty (Stokes 1930:2; Sorrenson 1977:468). Biggs (1969:12-14) proposed a complex method of dating based on biological factors such as the male and female age ranges of fertility, and sibling position. However, dating by year can be problematic when comparing genealogies from a multitude of different sources. The method used in this thesis is by counting the number of generations before 1900AD, so that '20GB-1900' indicates twenty generations before 1900. 1900 has already been suggested by Hiroa (1934:18) as a useful date for comparison. Most collected genealogies fall either shortly before or after this date and a minimal adjustment is possible without causing too much distortion.

²⁹ Known in Maori genealogy as 'taatai hikohiko'.

Variability in Tradition

Although authentically pre-European tradition can be considered as consistent, and as historically valid over some hundreds of years, it would be wrong to assume that it remained unchanged in same primordial fashion. Certainly there is a popular assumption that oral texts have been handed down word for word in an unaltered state over several generations (Robertson 1958:40). However, this is not the case as is evidenced by the considerable variation that occurs among the different versions of the main myth cycles and traditions. These were often deliberately varied according to occasion, knowledge and intent of the narrators (Biggs 1966:454). However, these were not so diverse as to be unrecognisable and appear to have fallen within a certain range of possibilities. For example Tiki, Ti'i, Ki'i appears as the first man or as a sculptured image in New Zealand, Rarotonga, Australs, Rapa, Societies, Tuamotus, Mangareva, Marquesas, Mangaia, Hawai'i. The names of Tane and Rongo appear in Tahiti, New Zealand, Mangaia and Hawai'i as gods and/or as either the twenty-sixth and twenty-seventh nights, or the twenty-seventh and twenty-eight nights of the lunar month (Hiroa 1926:195; Stokes 1930:7, 13-14). Additionally, in spite of the variation among the Maui and Tawhaki myths throughout Polynesia, the characters, plots, and main events remain substantially intact from what was probably some original single common body of lore. All this despite the separation between some populations of more than 1,000 years. In fact if those myths had an early origin in West Polynesia then they may be as old as 3,500 years, or more.

Many would also regard the traditions as unaltered factual records of the past. However, narrative recital was often deliberately selective. Rearrangement occurred in the narrative, to suit the main thrust of the general tradition and according to present purposes. Within local tribal groups there were several versions of the same event (Biggs 1966:454; Scarr 1990:59-60). At least one adept from the Maori schools of

learning acknowledged that genealogies and histories varied from tribe to tribe. Initiates had access to different schools. Variations occurred between different levels of initiates and the uninitiated. Deliberate attempts may have been taken to mislead the uninitiated (Stokes 1930:3-6). Samoan traditions were subject to a large amount of local colouring, and the genealogies revised in emphasis in accordance with the rise and fall of leading families. Another example is that the landing place of the first Tu'i Tonga is variously sited in Savai'i, Tutuila, or Manu'a (Nelson 1925:124-145). Some variation also occurred because of the inability of the memory to retain single versions over long periods of time. Elaboration, change, and contradictory versions were inevitable (Malo 1951:1; Irwin 1992:1).

Other factors also contribute to a multiplicity of versions. If settlement occurred at different times then this is usually reflected in genealogies of different length (Hiroa 1932b:16). Earlier genealogies are also difficult to assess because 'each migration and long settlement has had the effect of wiping clean the pre-migrational slate' (Stokes 1930:4). The genealogies of later immigrants who became dominant are generally well defined and those of older settlers more obscure. If the founding population is small then little is known and there is more of the fantastic. Displaced populations are minimised in the genealogy and removed to the periphery as marginalised realities. They are no longer remembered as real human beings but become ogres or fairies. In Rennell and Bellona the 'hiti' were killed off by new arrivals led by Kaitu'u. They and the 'fiti' in Tikopia were marginalised as the sources of strange sounds in the bush, or of strange shadows or light flashes that a lonely wanderer might meet in the wilderness (Monberg 1966:85-95; Scarr 1990:59-60). These stories are similar to those about the 'patupaiarehe' and the 'turehu' referred to by the Maori.

The transition from orality to literacy also caused change (Handy 1923:13). In fact, few if any Polynesian genealogies are still solely oral. Most are now written records into which have crept

many mistakes. The names of men and women have become transposed. Frequently the names of children are given in single column creating the appearance of consecutive generations in direct line. Some genealogies were deliberately confused in order to mislead foreigners (Stokes 1930:18).

Validating Tradition

Although the traditions did not correspond accurately in all detail, the evidence from early records suggests that the genealogies from different groups still approximated each other (Stokes 1930:3). To a certain extent large population and frequent tribal intercourse prevented distortion (Robertson 1958:40; Piddington 1956:1956:201). In another consideration of the problem Lavondes (1967:484) identified different aspects of tradition including: legends, folk tales, historical narrative, prayer, songs and chants. The major variations occur in the prose narrative rather than among the more fixed forms of poetic song and chant associated with the traditions. This constitutes a ledger against which the narrative can be compared. Ideally an accurate account would occur in a number of sources, including in songs, chants and incantations which also refer to tradition in great detail. The religious and public significance of songs and incantations mitigate against their containing spurious material. Literature, history and poetry are combined (Hiroa 1932b:15; Biggs 1966:454; Simmons 1976:8-12).

Genealogies can also be tested against the internal consistency of their own interlocking genealogical matrix which serves to relate characters to each other and to a wider group of contemporaries, antecedents and descendants (Simmons 1976:8-12). They can also be tested for their compatibility by comparison with the material produced from such disciplines as linguistics, archaeology, biological anthropology and the like. Suggs (1960:771-772) suggested that sound comparative studies of legends not only from Polynesia, but Micronesia, Melanesia and

Papua may also be of value. Roberton (1956, 1962) argued that although distortions existed, they could be compensated for by proper analytical techniques, the satisfactory assessment of which depended on the quantity and the quality of the material available. Survey of a wide field of tradition sometimes brings to light clear historical sequences which are not always apparent in the multiplicity of traditional accounts, and this constitutes a further pointer to general validity. Significantly, absolute validity depends on consistency, the same principle of evidence required in archaeology and linguistics. Unfortunately, in the case of very early traditions it is inevitable that frequently there is little material for analysis and comparison. In such a case continuity with subsequent tradition which can be shown to have validity points in favour of its acceptance. On the other hand, isolation in context warrants extreme caution. There is little doubt that some European theories have come to be accepted as traditional concepts by both Polynesians and Europeans. Notwithstanding these strictures, authentic tradition is capable of enduring the test of severe analysis. However, it is not prudent to assume validity without detailed analysis (cited in Howard 1967:293-294).

Informants also need to be validated. Emory (1940:69) found that to inform the Tuamotuans that Christianised accounts of creation were not authentic, and to inquire after what their ancestors had actually believed, invited reconstructions based upon whatever the informants thought might please the investigator (Emory 1940:69). In another example, a Marquesan informant gave two different versions three years apart. A second informant gave a further account. Because of variation there tends to be no 'original'. Part of the solution is to gather as many different versions as possible. This helps clarify the meaning of the narrative, following which a plausible hypothesis concerning main characters is possible (Lavondes 1967:486-487).

Manuscripts can be analysed to see if the authorship is indigenous or European. This can be achieved by evaluating the

language used or by comparing hand writing samples from possible authors. Internal references and variations can be checked. Oral informants can be adjudged according to their ability to speak the indigenous tongue, and their freedom from known bias such as Christianity. It is also more useful if their tribe, position and general reputation are known. If they are clearly identifiable as an authority that also helps. They should also possess a broad knowledge of tradition. Their purpose for giving information should also be known, whether for money, land claim, or gift. Tradition should also not be the invention of one person, nor a combination of elements from other traditions or areas or islands such as the Te Matorohanga/Whatahoro/Smith (1913) Lore of The Whare Wananga version of Kupe. Creative authorship is betrayed by an absence of antecedents in the traditional record (Simmons 1976:8-12). It is also useful to know whether or not informants have either travelled, or have managed to acquire and add the tales of other tribes and islands to their own. One must also be aware of mistakes, mistranslations, reinterpretations or exaggerations by Europeans. Informants may also change to please or make a joke, or for payment. More recent informants are generally only capable of divulging what has filtered down through several generations of people, who never lived fully in the culture they describe (Hiroa 1945:32-35, 65). Elbert and Monberg (1965) in their field trips to Rennell and Bellona also recorded location, age, name, biography of travels, genealogy and name of teacher (Lavondes 1967:497).

Summary

In the writer's view the genealogical recital is the core of oral tradition. All forms of song, chant, poetry and prose attach to various levels of descending genealogical matrices. For the purposes of considering the oral traditions of Polynesia, the following chapters include an analysis of the narrative prose pertaining to founding ancestors and canoe traditions. Those stories belonging to the mythical realm are not considered;

neither are those referring to mythological, semi-human demigods, although it is believed that these may have some basis in real pre-historical events. Aspects of song, chant and poetry are only considered briefly. These restrictions were applied firstly, because of the scope of the review undertaken, and secondly, because of the limited amount of time for analysis available to the writer.

What is accepted as genuine tradition is that tradition for which a reasonable case exists for its pre-European authenticity. It is accepted that all tradition varies, changes and evolves. Tradition is not static in some primordial unchanging sense. However, the dynamics of pre-European tradition were severely impacted upon with the arrival of the European. This occurred because of the access to a wider knowledge base, an increased ability to transfer knowledge, and contact with Christianity. As a benchmark, one can expect changes in the traditions within twenty years of Christian contact. Unfortunately in some cases, what is often now accepted as authentic tradition, particularly by indigenous peoples themselves, is often not the same as the traditions adhered to by their ancestors.

CHAPTER TEN

WEST POLYNESIA

This chapter contains a summary of traditions from several of the islands of West Polynesia and the Polynesian Outliers. Although much of the material is secondary, every attempt has been made to validate the data in terms of the discussion in Chapter Nine. Facts concerning population size, first European contact and the establishment of Christian missions have been included where such information was available. This basic information is useful in that it gives us an idea of how intact the pre-European traditions might be, and how much alteration may have occurred. Smaller populations are less likely to have retained long consistent interlocking genealogies, whereas larger populations most probably have. First European and Christian contact indicates roughly when traditions may have begun to change in response to the new influx of geographic, Biblical and other information. Where European and Christian influence was established late and subsequent ethnographic material recorded shortly after then there is a reasonable likelihood that much genuine pre-European material is extant. Where possible reconstructed material has been excluded. Fortunately, several researchers such as Elbert and Monberg (1965), and those from the Bishop Museum in Hawai'i have already gone to some length to validate the material they collected themselves.

The West Polynesian traditions describe a central region of contact centred around Fiji, Tonga and Samoa. This core region adjoins several other overlapping spheres of contact centred on

islands and island groups such as Tuvalu, Tokelau and Uvea each measuring from 500 to 1,000 miles across. When joined, the overall extended sphere of contact measures 3,000 miles east to west, from the Caroline Islands to the Northern Cooks.

The Polynesian Outliers

The Polynesian Outliers, span more than 1,500 miles of ocean. From the windward fringe of Vanuatu and the Santa Cruz Islands, they stretch from Sikaiana, Tikopia and Anuta in the east, through Ontong Java, Nukumanu, and Tauto, to Nukuoro and Kapingamarangi in the west. Typically they comprise small islands and atolls with populations usually less than a few hundred. Their traditions speak of frequent voyaging within localised island groups, and more intermittent longer voyages sometimes over hundreds of miles. Consistent with the predominant weather patterns several accidental voyages are recorded, usually from the east. A number of deliberate voyages supports the belief that early Polynesians possessed the ability to navigate over very long distances.

The Traditions of Kapingamarangi

Kapingamarangi is a tiny atoll about 400 miles northwest of New Britain, 185 miles south of Nukuoro, and 240 miles north of Nuguria (See Fig.37). The population of about 500 live on thirty-three islets totalling less than four tenths of a square mile. First sighted by Europeans in 1536 contact was minimal until 1880. In 1910 a German expedition recorded much pre-European material. There were also two visits from the Bishop Museum during 1947 and 1950 (Emory 1965:1-5, 12-18).

According to their traditions the people descend from Utamatua and his wife Roua who came from a land called Tamana in 6GB-1900. Kapingamarangi was already inhabited. Tamana is unidentified. The

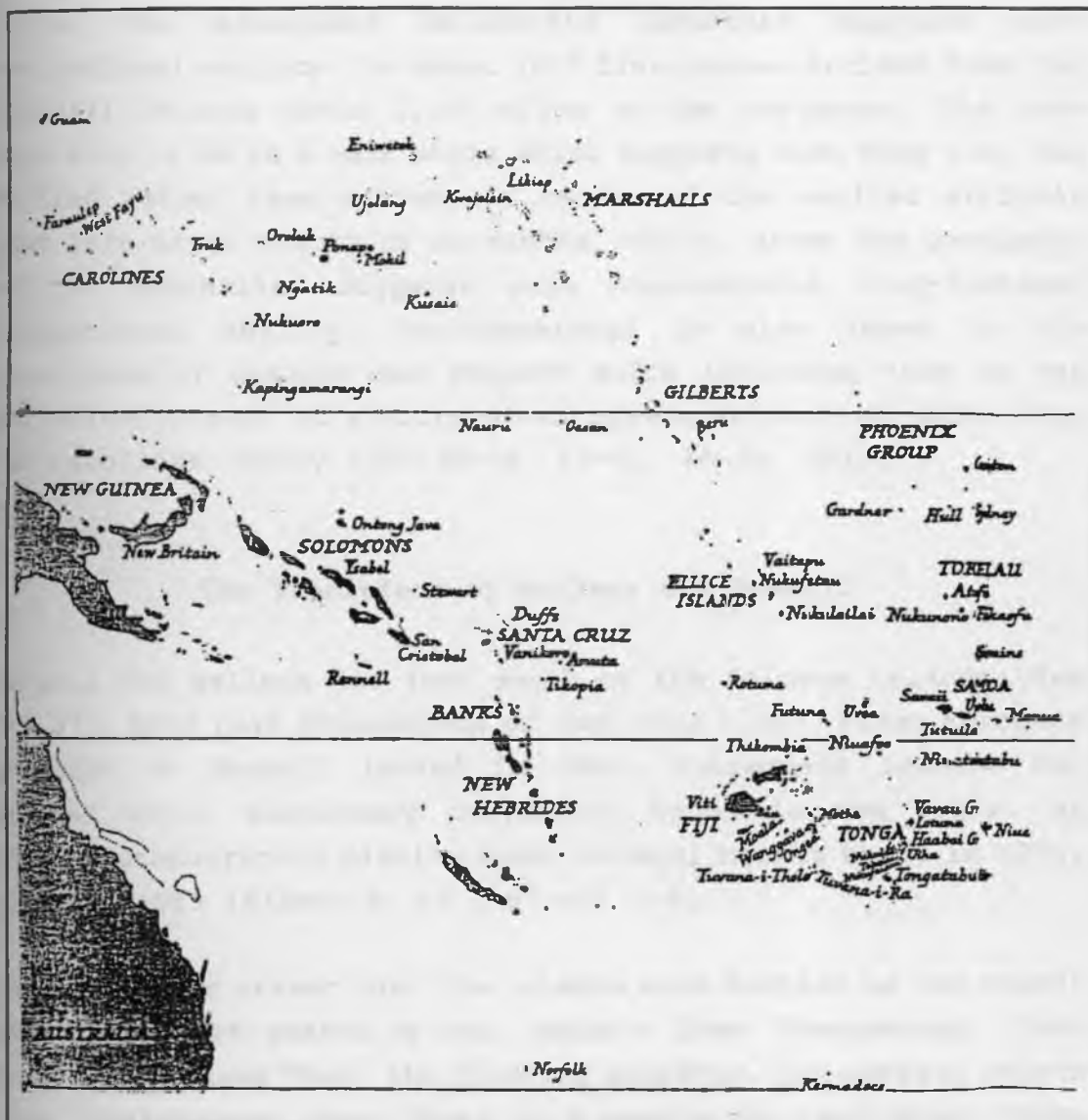


Figure 37: West Polynesia and Polynesian Outliers (Golson 1962:Inside Cover).

traditions make reference to two occasions when canoes arrived from the West Carolines, 200 to 300 miles to the northwest. One landed in Kapingamarangi about 5GB-1900. Many of the crew stayed and are remembered, and some sailed away. Both arrivals were likely drift voyages. For example, one is described as a paddling canoe. The subsequent deliberate departure suggests some navigational ability. In about 1870 five canoes arrived from the Marshall Islands about 1,100 miles to the northeast. The crew were said to be in a weak state which suggests that they too, had drifted rather than sailed. In repeat of the earlier arrivals they left after twenty or so months, which, given the proximity of the Marshalls, suggests some considerable long-distance navigational ability. Kapingamarangi is also known in the traditions of Lukunor and Nukuoro which indicates that it was periodically part of a Micronesian sphere stretching north into the Carolines (Emory 1965:28-30, 37-41, 46-54, 201).

The Traditions of Bellona and Rennell

Rennell and Bellona lie just south of the Solomon Islands (See Fig.37). Both have populations of less than 1,000. First European arrivals on Rennell landed in 1856. Subsequent contact was minimal until missionary conversion began in the 1930s. An Finnish ethnographic mission spent several months there in 1958, 1962 and 1963 (Elbert et al 1965:vii 1-6).

The traditions attest that the islands were settled as the result of a deliberate search by sea. Kaitu'u from 'Ubeamatangi (East Ubea) or Hutunama'Ubea, the founding ancestor, led several others from 'Ubeaangango (West Ubea) in a search for land about 20GB-1900. Several islands were visited during their search. Finally they landed at Rennell, and then went on to Bellona (Elbert and et al 1965:173-188; Monberg 1966:32, 92). A connection with Uvea and Futuna 1,250 miles to the east is suggested by the name Hutunama'Ubea. Several return voyages are purported about 20GB-1900 when Ngatongaboibangu and his son Ngatongamatu'a, made trips

to 'Ubea to fetch tumeric to be used in religious ceremonies (Roberts 1958:3-10; Elbert and Monberg 1965:257-259). These return voyages contradict the school of thought which argues that the nearly 1,000 miles divide between the Outliers and West Polynesia was crossed only by east to west drift voyages.

There are also several stories of Rennellese and Bellonese adventurers who raided in amongst the 550 mile long chain of the Solomon Islands (Elbert and Monberg 1965:369, 384-390).

Drift voyages are also recorded including two stories about arrivals from Taumako in 9GB-1900, and 2GB-1900. Some of these people remained and married locals while others made deliberate departures. It is uncertain whether or not Taumako is the island of the same name in the Duff Islands 450 miles eastward. There is also a short account of two castaways from Tikopia 600 miles to the east. There are several other stories of undated canoes. One tradition concerns Maige who arrived from Gotuma or Ngotuma in 7GB-1900 as part of a raiding party that was wrecked on the north coast of Rennell. It is not known if Gotuma is really Rotuma 950 miles eastward (Elbert and Monberg 1965:370-383).

According to their traditions these islanders were capable navigators who were at home on the sea. It is also suggested that although canoes were frequently blown westward by the predominant trades, many found it possible to make returns sometimes over great distances. Some considerable sailing ability is implied.

The Traditions of Anuta and Tikopia

Anuta and Tikopia are small Polynesian Outliers 100 miles northeast from Vanuatu, and eighty to 100 miles east of the Santa Cruz Islands (See Fig.37). The Anutan genealogical record begins at about 10GB-1900. Descent is traced from Kaurave and Pu Taupare, said to be from Tonga and Uvea respectively. After the arrival of Pu the traditional history of Anuta is one of struggle

and conflict caused by the continual arrival of outsiders. Arrivals from Tonga, Samoa and Tuvalu are mentioned. Two deliberate voyages to Uvea and Tonga are claimed. Tikopia was settled by Pu Lasi who founded the Taumako Lineage. He also made several return voyages between Tikopia and Anuta. On one of his final visits to Anuta he is said to have found a collection of people living there from Uvea, Samoa, Tonga and Rotuma (Firth 1954 :102, 121-123; 1961:109-110; Yen et al 1973:6-8; Freinberg 1978:304-305).

These traditions support the view that frequent east to west drift voyages occurred or that voyagers took advantage of those winds to cross the West Polynesian/Outlier divide purposefully. They also indicate that at least some deliberate west to east voyages may have been made.

The Outlier traditions are generally consistent. 'First arrivals' usually refer to the first most well remembered ancestors. These arrivals generally occur some time after archaeological evidence for original occupation in the region.³⁰

Northern-West Polynesia

For the convenience of analysis West Polynesia has been divided into two broad geographically based groups; Northern-West Polynesia and Southern-West Polynesia. Northern-West Polynesia includes Tuvalu (Ellice Islands), Kiribati (Phoenix Islands), Tokelau (Union Islands), Rotuma, Uvea (Wallis Island), and Futuna (See Fig.37).

³⁰ See Chapter One.

The Traditions of Tuvalu

Tuvalu is a nine island chain some 350 miles long (See Fig.37). Stories about settlement vary from island to island. Genealogies and oral traditions mostly go back between 300 to 700 years. As with the Outliers most stories relate to later arrivals and not the earliest ancestors. Most ancestors seem to have come from Samoa, Uvea, Tonga and Micronesia (O'Brien 1983:14-16).

The founding ancestor in Nanumea was Tefolaha, a Tongan, who found two women already in residence, whom he sent away to Kiribati 500 to 600 miles northeast. Tefolaha had sailed from Samoa arriving in Nanumea 800 to 1,000 miles to the north-west. Later he made a return voyage to Samoa and Tonga. After the arrival of Tefolaha other Tongans raided the island over several generations. One party was said to have arrived in an armada of eleven canoes. The island was also raided by people from Kiribati and Tungaru (the Gilbert Islands), 150 to 200 miles northeast (Isako 1983:48-52). Nukufetau and Nanumaga were also settled by Tongans. The traditions of Nukufetau contain several stories about repelling Tongan raiders (Lafai 1983:66-67; Lafita 1983:86-87).

On Niutao the original inhabitants were joined by later settlers from Samoa. After this, raiders from Kiribati killed most of the inhabitants (Nia 1983:58-59). The first settlers on Nui were also Samoan. One account places them 27GB-1568 (the arrival date of Mandana). This island was also raided by Kiribatians. Another canoe is recorded arriving in Nui from Beru in the Gilbert Islands about 400 miles to the northwest (Pape 1983:71-76). Vaitupu and Funafuti were settled by another Samoan named Telematua about 16GB-1900. His grandson, Silaga also made a return trip to Tonga (Laupepa 1983:78). In Samoan tradition there is a story about two of the sons of the Malietoa La'uli who settled on Vaitupu in 15GB-1900 (Smith 1897:25). The Funafuti traditions record that raiders from Kiribati frequently called

in at Funafuti whilst on their way south to fight the Samoans. The route through Tuvalu is about 1,000 miles long (Kennedy 1929:5; Ielemia 1983:92-93).

The traditions of Tuvalu speak of a voyaging corridor 700 miles wide from Tuvalu to Kiribati, and 1,400 miles long from Tungaru to Tonga. The intervening gaps without islands range from 200 to 600 miles depending on the points of arrival and departure. Sharp's (1956) argument that voyages were restricted to within island groups except for accidental crossings is not supported. Interestingly, there is also a tradition about one canoe being navigated by two women, the captain being Nei Ruruobu (Pape 1983:71-76). Another story is that bonito blood was drunk to alleviate thirst (O'Brien 1983:14-16).

The Traditions of Tokelau

Tokelau comprises four reef surrounded atolls, being Olosenga, Fakaofu, Nukunono, and Atafu, lying on a general northwest-southwest line 250 miles north of Samoa, 300 miles south of Kiribati and 500 miles east of Tuvalu (See Fig.37). People on Olosenga were first seen by Europeans in 1606. Subsequent contact was sparse until the arrival of missionaries in 1859. Tokelau became a British Protectorate in 1894 and voyaging to Tonga, Samoa, Fiji and the Cook Islands ceased by government decree. A Bishop Museum expedition visited the islands during October to December 1932 (Burrows 1923:145, 148; MacGregor 1937:4-5, 12-13, 28-30).

According to the traditions an earlier people living on Atafu, Nukuono, and Olosenga islands, were driven out by a second group who landed on Fakaofu about 11GB-1900. One legend says Kava and Pi'o led this second group and that they came from Samoa. Another account names Kulu and Ona, a man and a woman, as those settlers. The first chief of Fakaofu was Kava Vasefanua. After the war of conquest some of the defeated people escaped by sailing to Tuvalu

and Samoa. Others may have fled to Tikopia, Sikaiana, or Ontong Java, 1,100 miles to the west. Some people on those islands claim descent links with Atafu and Te Vaka, the son of Kava (Newell 1895b:238-239; Burrows 1923:148-149, 152; MacGregor 1937:12, 17-19, 20-22).

The traditions also tell of Tokelauan navigators who voyaged to Fiji, Samoa and Tonga. Attacks by Tongan raiders are also recorded. Samoans are also said to have voyaged to Tokelau and this is mentioned in Samoan tradition. One such canoe was captained by Lekenā who left behind two men named Folinga and Latu. On Fakaofu they also knew of Manihiki, Tongareva, and other atolls east of Pukapuka about 300 to 750 miles distant (Burrows 1923:149-152; MacGregor 1937:26-32). There is one post-European contact record of eleven Manihikians deliberately sailing to Olosenga (MacGregor 1937:26-32). This is contrary to the common perception of quite separate Western and Eastern Polynesian spheres of voyaging. Links with Tungaru and Banapa (Ocean Island) lying 800 to 1,200 miles northwest are also suggested (Tutuila 1892:262-263).

Another aspect supportive of navigation is the retention of the names of several navigation stars and constellations in the traditions. Fetu Ao or Kui Salimona, a morning star, was used for easterly bearings, and Famau Malanga, an evening star, for westerly bearings. Na Tangata refers to two stars used for the voyage to Samoa. The three stars in the belt of Orion were known as Tolu, and were used as a direct guide from Nukunono to Atafu (MacGregor 1937:89).

Drift voyages are also recorded in the traditions. There is one story of an Uvean being blown to Fakaofu. One Tokelauan, Te Fou, was carried by storm to Futuna where he was killed. In 1826 and 1827 two Tokelauan canoes were blown to Rotuma where the castaways settled. Tu and Fafie were blown from Tokelau to Uvea about 6GB-1900 (MacGregor 1937:22-23, 27-28).

Tokelauan tradition records both accidental and deliberate voyaging, and a broad zone of contact west to Tuvalu, Uvea and Futuna, and south to Tonga, Fiji and Samoa. The contact pattern is consistent with those in other West Polynesian traditions. One interesting point is the eastern contact beyond Pukapuka. The orthodox scenario for the settlement of the Pacific suggests that the Marquesas were the first islands settled in East Polynesia. One counter-argument is that earlier settlement probably occurred in the Cook or Society Islands because they lie closer to West Polynesia than the Marquesas. However, the islands of Pukapuka, Tongareva, Manihiki and Rakahanga form an arc of islands with shorter intervening gaps than from West Polynesia to the Cooks. Early voyagers could have used to island hop across to the Tuamotus and the Marquesas.

The Traditions of Rotuma

Rotuma is about 150 miles south of Tuvalu, 300 miles north of Fiji and 450 miles east of Tikopia (See Fig.37). Initial European contact was in 1791. Missions were established in 1839. According to the traditions an earlier population was later overrun by two waves of Polynesian invaders from Samoa. Other invasions followed including one from Tonga led by Ma'afu. Other arrivals appear to have been from either Tikopia or Ontong Java 1,150 miles to the west. A group of castaways from Tungaru, 840 miles northwest, reached Rotuma in the early eighteenth century (Russell 1942:229-230; Irava 1991:7-12).

The contact zone for Rotuma is extensive. One notable aspect in the traditions are the suggested deliberate voyages arriving from the Santa Cruz-Bismarck Archipelago area. These voyages are again contrary to the prevailing winds and the general trend of east to west drift. An ability to sail across the wind and to exploit seasonal westerlies is again supported and this is consistent with several of the traditions from the Outliers.

The Traditions of Uvea

Uvea is 190 miles west of Samoa, 240 miles north of Fiji, and 300 miles southeast of Tuvalu (See Fig.37). The early twentieth century population was about 4,000. First European contact was in 1767 and missions were established in 1837. Many traditions were recorded before 1830. A Bishop Museum expedition visited the island in 1932 (Burrows 1937:3-8).

The traditions of Uvea describe frequent return voyaging to Tonga, contact with Tokelau, Fiji, and Futuna. Some accounts are that Uvea was settled by several waves of Tongans beginning with Tauloko, who lived 30GB-1900. After the death of Tauloko, Nga'asialili arrived from Tonga. When returning to Tonga, his canoe was driven off course and landed at Futuna where he later died. During the time of the third king of Uvea, Havea Fakahau, a large canoe called the *Lomipeau* was used to transport stone for monuments to Tonga. In the time of the sixth Uvean king Fakahenga, the Tongans with the help of some Tokelauans invaded Uvea. These forces were met and defeated by a combined force of Uveans, Fijians and Futunans. The story of this war describes the extent of voyaging in the West Polynesian archipelago. One Uvean, Tupavaitupu became a renowned navigator. When he was older it was said he could still navigate even after he had become blind (Burrows 1937:18-37).

A possible connection also exists with Rennell and Bellona said to have been settled from 'Ubea. Another possible connection is with Rotuma where a small isle is called Uvea. No explanation for either exists in Uvean tradition. One Rotuman tradition says that the Tu'i Uvea went to Rotuma with his daughters, Ria and Ofu, about 9GB-1900 (Burrows 1937:49-50). There is also a small isle fifty miles off the coast of New Caledonia whose former name was altered from Lai to Lai-Uvea after an accretion of Polynesians in the late eighteenth century (Priday 1950:245-248).

That the Uveans were capable navigators is also supported in the records of early missionaries. The frequency with which they departed on voyages was commented on by Bishop Bataillon in 1860 when he wrote 'This is, at present, the principal wound of these missions, and we force ourselves by all possible means to combat it and cure it' (cited in Burrows 1937:48). Another observer noted that such voyages to neighbouring archipelagoes declined because of the availability of transport by steamer, but they still amounted to about ten each year (Burrows 1837:49).

These traditions indicate a zone of contact 800 to 1,000 miles wide at its broadest point between Tokelau and Fiji, and Tokelau and Rotuma. If the Rennell-Bellona connection was valid, the range could be extended 1,300 miles to the west.

The Traditions of Futuna and Alofi

Futuna and Alofi lie about 150 miles northeast of Fiji, and 250 miles west of Samoa (See Fig.37). In 1930 the population was about 1,300. First contact occurred in 1616 and a French mission was established in 1837. A Bishop Museum expedition visited the island in 1931 (Burrows 1971:4-26).

In one main account the kings of Futuna are said to have been Samoan. The traditions also speak of several invasions from Tonga. Two accounts speak of one battle where a large Tongan army was slaughtered to a man by the people of Alofi. In another story the sons of two chiefs who travelled to Tonga from Futuna, were captured and later escaped. They were subsequently killed by a force from Vava'u. Frequent contact is recorded with Uvea and also with small expeditions travelling to Fiji. Another island of possible contact is Sikaiana (Stewart Island), 1,200 miles westward, which both the people of Futuna and Sikaiana claim was settled from Futuna. Traditions from Sikaiana also tell of voyages from Tonga, Samoa, and Tuvalu. There is also a small island in southern Vanuatu named Futunalalo, about 750 miles

southwest, which the people of Futuna claim was settled from their island. There are also extensive accounts of boat loads of Futunan fisherman having been swept out to sea. Other stories refer to exile because of defeat in war, and departure because of an eagerness to see new lands. Such departures are also well documented during the time of the early missionaries (Smith 1892:33-34; Burrows 1971:26-53).

There is one tradition of a 'Chinese' arrival in Futuna. There are varying accounts, although generally what they say is that this occurred between 150 to 350 years before 1930. Apparently the arrivals numbered between 100 to 400. They settled for some time before being killed by the Futunans. The boat is described as box-like, seemingly a fitting description of a canoe from the Marshall Islands 1,400 miles northwest. The naming of the immigrants as Chinese seems to have been post-European (Burrows 1971:54-55).

Burrows suggests that inter-island contact was so frequent within the area that peaceful visits between Futuna, Uvea and Samoa hardly warrant recording in tradition (Burrows 1971:56, 230-231). Overall the contact zone extends some 1,000 miles north to south, and possibly further west because of drift voyaging.

Southern-West Polynesia

Southern-West Polynesia includes the Lau Islands of Fiji, Tonga, Niue (Savage Island) and Samoa. The traditions of this region describe a West Polynesian contact zone of frequent voyaging for reasons of trade, warfare, intermarriage and alliance. The islands on the periphery of this zone have their own contact spheres extending beyond the core into Micronesia, northern East Polynesia, and, through a mix of frequent accidental voyaging and less frequent deliberate voyaging, across to Melanesia, Vanuatu, Santa Cruz and the islands of the Bismarck Archipelago.

The Traditions of the Lau Islands

The Lau Islands are a chain of 100 small islands and reefs lying about 150 miles east of Fiji, and 250 miles west of Vava'u in Tonga (See Fig.37). Lakemba, Naiaua, Kambara, Mothe, Oneata and Thithia are the main chiefdoms. The already inhabited Kambara was settled by Ndaunisai, whose origins are unclear, in 12GB-1900. He and his sons then launched a campaign of expansion which continued into subsequent generations (Thompson 1940:1, 29-37).

The traditions speak of much trade with Fiji and Tonga. The Tongans initiated trade because of the hardwood found in Southern Lau which they used to build superior large double canoes. The construction of the largest type of double hulled canoe took up to two years and only a chief could command the resources and labour necessary to build one. Gradually colonies of Tongans grew up in Lau, Vanua Levu, and the islands of the Koro Sea. Trade continued on a frequent basis, except during the northwest monsoon (Thompson 1940:177-212). The length of time and investment required to build large scale canoes supports the experience of the *Hawaikinui*. That venture showed that the investment of time and resources probably acted as a restraint on very long voyages unless undertaken for very good reasons.³¹

The Traditions of Niue

Niue lies 240 miles east of Vava'u in Tonga (See Fig.37). The early twentieth century population was about 4,000. First European contact was with Cook in 1774. Missions were established in 1830. Conversion was unsuccessful until well into the 1840s. The first permanent European resident did not arrive until 1861. Much of the information here is based on fieldwork undertaken during seven months in 1923 and 1924 and one old manuscript of

³¹ See Chapter Seven.

unknown date (Loeb 1926:3-5, 30-43).

According to tradition there were three main migrations to Niue. The first was led by Huanaki and Fao from Samoa. This tradition is rather vague and could refer to very early, almost forgotten settlers. The second migration occurred in the early sixteenth century and consisted of a Tongan war expedition. The third was led by another Tongan named Mutalau, whose mother was Niuean, and took place toward the end of the seventeenth century. Contact continued with Tonga including a subsequent migration led by a woman named Ninifale. In another tradition Laufoli who lived 6GB-1900 went to Tonga in order to test his martial skill. He then married the daughter of a Tongan chief and later returned to Niue. Raids by Tongans were still occurring when European contact was first established (Smith 1902:98-99; Cowan 1923:239; Loeb 1926:24-67, 146-223).

The Niuean traditions contain little of contact with islands outside of Tonga and Samoa. This is probably due to its isolation in the southeast corner of the West Polynesian archipelago.

The Traditions of Samoa

Samoa comprises the main islands of Manu'a, Savai'i, Tutuila and Upolu (See Fig.37). As with most other Polynesian communities the Samoans have lost practically all recollection of their first settlement (Nelson 1925:126). It is believed that Samoa was peopled from a multitude of places and this is reflected in the traditions. The island of Manu'a is commonly said to have been settled first. One mythical version is that the first Tu'i Manu'a was a descendant of Tagaloaalagi the divine god and creator of the universe, day and night, life, and the islands of Fiji, Tonga and Samoa. According to others he was the descendant of one Galeai high chief of 'Fitiuta'. Another tradition has Atafu in the Tokelau as a land of origin for the other islands of Samoa. According to this tradition Lutafao travelled to Atafu where he

married the daughter of the Tu'i Atafu. His daughter Luau'i later married the Tu'i Manu'a in Samoa and their son Luotangaloa became the first chief of Upolu. In a third account one Fanga, an early settler on Savai'i, later crossed to Upolu and settled A'ana. Fanga was from 'Pango' which is unidentified. There is a place of that name on Fate in Vanuatu. Another early settler, Pili landed on Savai'i and found both that island and Upolu already settled (Fraser 1892:181; 1897:20-33; 68-75; 117; Stair 1895:47-53; Mead 1930:171-196; Meleisea 1987:2-6; Henry 1993:21).

The traditions describe frequent contact throughout the West Polynesian archipelago. In one story Fitiaumua ruled over both Samoa and Fiji. At another time the Tu'i Manu'a reputedly ruled over Samoa, Tonga, Uvea and other islands. The first Tu'i Tonga Ahoaitu, said by some to have been from Samoa, and known to them as Asoaitu, came to dominate Niue, Uvea, Futuna and Rotuma. He later conquered Samoa. Three hundred years later the Tu'i Tonga Tala'aifei'i was driven out of Samoa by Tuna and Fata. This led to the creation of the title 'Malietoa' first held by Savea Tuvaelua who lived about 27GB-1900 (Turner 1884:5, 253-254; Ella 1899:231-233; Meleisea 1987:31, 203, Henry 1993:21-41).

Other traditions collected in 1871 describe contact with Niue and Fiji. A couple from Manu'a were expelled because the pregnant wife ate taro reserved for their landlord. They escaped to Niue where they raised their son Fitiaumua who later conquered Fiji and Tonga. Eventually he was killed during a subsequent attempt to reconquer Samoa. Later his foster brother Laufoli came from Niue and conquered Manu'a, Tutuila, and Upolu (Fraser 1900:126-134). Records of intermarriage reinforce the concept of continual contact throughout West Polynesia. About 21GB-1900 one Tu'i Tonga married a daughter of the Tu'i Fiti (Fiji). His daughter Laufafaetoga, married Tupainatuna, a Samoan. She gave birth to her son in Fiji and they later returned to Samoa. In another story Taumatamu who lived 19GB-1900, and whose great-grandfather was Fijian, had a son, Samoanagalo, who was kidnapped and taken to Tonga, where he was adopted by the Tu'i Tonga. He later had

an affair with Fitimaupologa, the daughter of the Tu'i Tonga and fled with her to Samoa (Nelson 1925:130-141; Turner 1884:224-265).

Some aspects of canoe building and navigation are retained in the traditions. These attest to the seaworthiness of craft, and the ability of mariners to overcome adversity such as thirst on long voyages. Amonga (Orion's Belt) was the usual star guide to Tonga. Ocean going canoes called 'va'a-tele' or great canoes were said to be able to carry two large fishing canoes. Special leaves were chewed which enabled mariners to drink some sea water (Stair 1895:48-49; 1895b:108-112).

There are also several traditions of post-contact origin. Percy Smith (1898, 1911) linked the Rarotongans with the Samoans using a genealogy of 115 generations. The Samoan traditions only have record of about forty (Nelson 1925:126-128). Newell (1895:231-234) published an account linking Peru island in the Tarawa Archipelago with Samoa. He claimed that one Nareau made a deliberate return from Samoa to Tarawa. However, the claim of this occurring at 77GB-1900 is suspect simply because the date is far too precise and distant to be accurate. The story itself may have originated within the traditions, but was later incorporated into a reconstruction. The Samoans have no tradition of this canoe although it may be that they retain fewer stories pertaining to the smaller northern islands given their more important political and trading connections with Fiji and Tonga.

The Traditions of Tonga

There are three main island groups in Tonga, Tongatabu, Ha'apai, and Vava'u (See Fig.37). The early twentieth century population was about 25,000. First European contact was with the Dutch in 1616, but was then infrequent until 1800. A strong Christian influence was established during 1840s. Much of the information presented here was obtained by an ethnographic expedition in 1920

and 1921. Other records were collected as early as 1817 (Gifford 1929:1-5, 51).

The three main dynasties in Tonga are the Tu'i Tonga, Tu'i Ha'a Takalaua, and Tu'i Kanokupolu. The latter two arise historically from the former. The Tu'i Tonga was highest in rank but lost power and influence as the other lines gained. There is no tradition of original migration which according to the archaeology occurred up to 3,500BP. However, there is the story of the arrival of Ahoeitu, the son of a Tongan woman and Eitumatupua. Ahoeitu was also the first Tu'i Tonga and lived about 36GB-1900. Many suggest he was from Samoa. Tonga was already populated. Little is known about the second Tu'i Tonga down to the ninth Tu'i Tonga Afulunga. The thirty-ninth and last Tu'i Tonga Laufilitonga died in 1865.³² From Ahoeitu to Laufilitonga is about thirty-five generations (Gifford 1924:25, 38; 1929 12, 48-54; Collocott 1924:168-170; Bott 1982:90-92).

The traditions mention much ongoing peaceful contact with other islands and immigration by foreigners. Two influxes from Fiji are recorded. The first important accretion from Fiji was led by Tu'i Motuliki. The second was from the island of Lakemba and occurred during the sixteenth or seventeenth centuries. The occasion was marriage of Tapuosi, the Tu'i Leka of Lakemba, to the female Tu'i Tonga Sinaitakala. It is also worth noting that at least four 'tamaha', the daughter of the eldest sister of the male Tu'i Tonga, had Tu'i Lameka from Fiji as fathers. Other immigrations from Samoa, Rotuma and Tokelau are also recorded. The principal migration from Samoa probably occurred in the latter half of the sixteenth century. A number of Rotumans are said to have settled in Tongatabu. There are also traditions associated with accidental drift from East Polynesia including mention of castaways from Aitutaki and Tahiti. Both groups were absorbed into the population. There is also suggestion that Tongan castaways settled Tikopia, 1,000 miles westward and some

³² Other lists contain up to forty-eight Tu'i Tonga.

speculation that the inhabitants of Ontong Java are descendants of Tongans. The lack of two way contact suggests that the Outliers were reached via drift voyage (Gifford 1929:12-15, 50, 80-81; Collocott 1924:).

The purport of the Tongan traditions is that they were expansive and capable voyagers. They declare that at various times during their history the Tongans held sovereignty in Samoa, Futuna, Rotuma, Niue, and Uvea. These claims are consistent with the other traditions in the region. The traditions of Tuvalu and Tarawa in Tungaru, 500 to 1,100 miles northwest also speak of previous Tongan tyranny. The Fijians are also said to have known of their power and dreaded it. The traditions indicate that Tonga dominated Samoa during the time of the tenth and eleventh Tu'i Tonga. This is recorded in the traditions of Samoa as is the Tongan decline. The twentieth Tu'i Tonga Tatafueikimeimua is known primarily through his wooing of the beautiful Samoan woman Hina. The sixth Tu'i Ha'a Takalaua, or twenty-ninth in succession from Ahoeitu, married a Samoan woman and installed his son Ngata as first Tu'i Kanokupolu. In another story the twenty-second Tui Tonga Havea II was killed by a Fijian named Tuluvota. The twenty-third Tu'i Tonga Takalaua was murdered at Tongatabu. His sons captured the murderers after a prolonged pursuit and fighting in Tongatabu, Eua, Ha'apai, Vava'u, Niuatoputapu, Niuafo'ou, Niue, Samoa, Futuna, Fiji, and lastly Uvea. The twenty-sixth and twenty-seventh Tui Tonga Piupiuafatu and Tui Tonga Kauulufonua also had Samoan mothers. The twenty-ninth Tui Tonga Uluakimata I is attributed with the transportation of huge stone blocks from Uvea to Tongatabu on board the *Lomipeau* for the construction of his royal tomb. This legendary canoe is already mentioned in the Uvean traditions. In another story it is related that the Uveans transported a force of 500 to fight in Tonga (Gifford 1924:31-36; 1929:13-15, 54-71; Collocott 1924:180-182).

In support of the proposal that land was discovered by following migratory birds Tongan tradition makes reference to pigeons (*globoicera pacifica*) which migrate from Samoa to Tonga in October

and return in March (Gifford 1929:70). In another interesting tradition the Tu'i Ha'amea Loau from Tongatabu made a famous voyage to 'beyond the horizon' while spending much time lying on the deck of his vessel in much the same manner as that described by Lewis in Chapter Four when observing zenith stars during his voyage to New Zealand (Gifford 1924:140-141).

Summary

There are two hypotheses regarding the occupation of the Polynesian Outliers. The first is that they were peopled by remnant populations left behind as the Polynesians advanced into Polynesia. The second is that they were settled by east to west drift voyages or by deliberate voyages of settlement or exploration from Polynesia (Kirch et al 1982:3). The traditions clearly show a continual influx of accidental voyages arriving from the east. However, they also suggest that at least some deliberate voyages were made between West Polynesia and the Outliers. Two-way return voyages are also implied. This is antithetical to Sharp's (1956) theory of west to east settlement by drift voyage.

It is also clear that a central West Polynesian contact region existed which was bounded by Samoa, Fiji and Tonga. This is fairly much as suggested by Sharp (1956) except he did not allow for voyages beyond 300 miles without intervening islands. The traditions consistently state that this core region was further linked with several other overlapping zones of contact, each of which is itself centred around an important island or island group. When linked with the Tokelauan contact zone the overall total region of contact is extended 800 miles northeast of the centre of the core to the Northern Cooks, and 900 miles north through Tuvalu to Kiribati and 1,200 miles northeast to Tungaru. From the core, through Uvea, Rotuma and Futuna the overall region extends nearly 1,700 miles to Ontong Java. There is a gap with little mention of contact south from Kapingamarangi, however,

contact from there and Nukuoro extends the greater Polynesian zone of contact 300 miles northwest into the Carolines and 1,100 miles northeast to the Marshalls. Similar patterns of overlapping zones of contact would be expected upon analysis of Micronesian traditions.

In line with Sharp's (1956) argument the traditions also show that voyaging was more frequent within island groups or between islands that were in close proximity. They also tend to agree with his view that the longest stretches over open sea were about 300 to 360 miles. However, the traditions also show that intermediate islands were used as stopovers for voyages considerably beyond 300 miles in length. Voyagers also possessed the ability to make even longer non-stop voyages if necessary. That such voyages were not always attempted seems entirely sensible if an easier alternative existed by using stopovers. However, that they did occur, albeit on a less frequent basis, over several hundreds of miles and even up to and beyond 1,000 miles is clear. The requirements for such voyaging seemed to rest on the motivation for the voyage, and the ability to mobilise sufficient resources to mount such an expedition. The major reasons for were probably settlement, warfare and deliberate return after accidental voyage. That they were not everyday events does not mean they were not possible. Sharp's view that voyages were limited by the lack of an ability to navigate over longer distances does not apply.

Another characteristic of the traditions is that they retain little in regard to navigational lore. There appear to be two reasons for this. Firstly, voyaging was so common that the lore was often taken for granted and not thought important enough to be included. Secondly, the analysis here is somewhat restricted to the prose narrative although various chants with regard to voyaging were sighted by the writer. Following this, it is also likely that the records of navigational lore are contained in the more esoteric elements of orality such as chants and prayers. Further analysis is warranted.

The West Polynesian traditions are compelling in their consistency. Almost all claim 'first arrivals' as settlers arriving after other, almost forgotten original inhabitants. Those islands with smaller populations retain shorter genealogies. Long distance voyaging from the Outliers is less frequently mentioned. They of course had smaller communities with fewer resources to mount such expeditions. The islands of the Northern-West Polynesian region describe more localised inter-island voyaging than the Outliers. This accurately reflects the geographic nature of their groups in that they are groups composed of a multiple number of smaller islands situated in close proximity to each other. They mention a greater number of external long distance voyages than the Outliers which again is to be expected given the broader resource base available within the groups. The Southern-West Polynesian traditions contain the longest genealogies simply because they had the larger population bases required to sustain them. They also speak of a much higher level of inter-island contact. Again, this is as one would expect given the close proximity of the large Fijian, Tongan and Samoan archipelagoes. Long distant voyages related to important intermarriages, political matters and warfare are also more frequently mentioned. This is consistent with what one would expect given the proximity of three large, populous, and powerful island groups.

CHAPTER ELEVEN

EAST POLYNESIA

For the purposes of this summary, the islands of East Polynesia are considered according to various geographical groupings. These include the Northern Cook and Southern Cook Islands, which are considered separately. The Austral Islands and Rapa, Mangareva and Easter Island as the Southern Belt. And, the Society Islands, the Tuamotu Islands, the Marquesas, and Hawai'i as the Eastern Islands. As in the previous chapter, information concerning population size, European and Christian contact has been included.

The Northern Cook Islands

The Northern Cook Islands include Pukapuka, Rakahanga, Manihiki, Tongareva, Suvarrow and Nassau. The centre of the group is situated about 600 and 800 miles northwest of Rarotonga and Tahiti respectively, and 500 miles east of the centre of the islands of Samoa (See Fig.38).

The Traditions of Pukapuka

Pukapuka is 390 miles northeast of Samoa, and 715 miles northwest from Rarotonga (See Fig.38). The early twentieth century population was about 500. First European contact occurred in 1765. Subsequent contact was sparse until 1857 when missions were

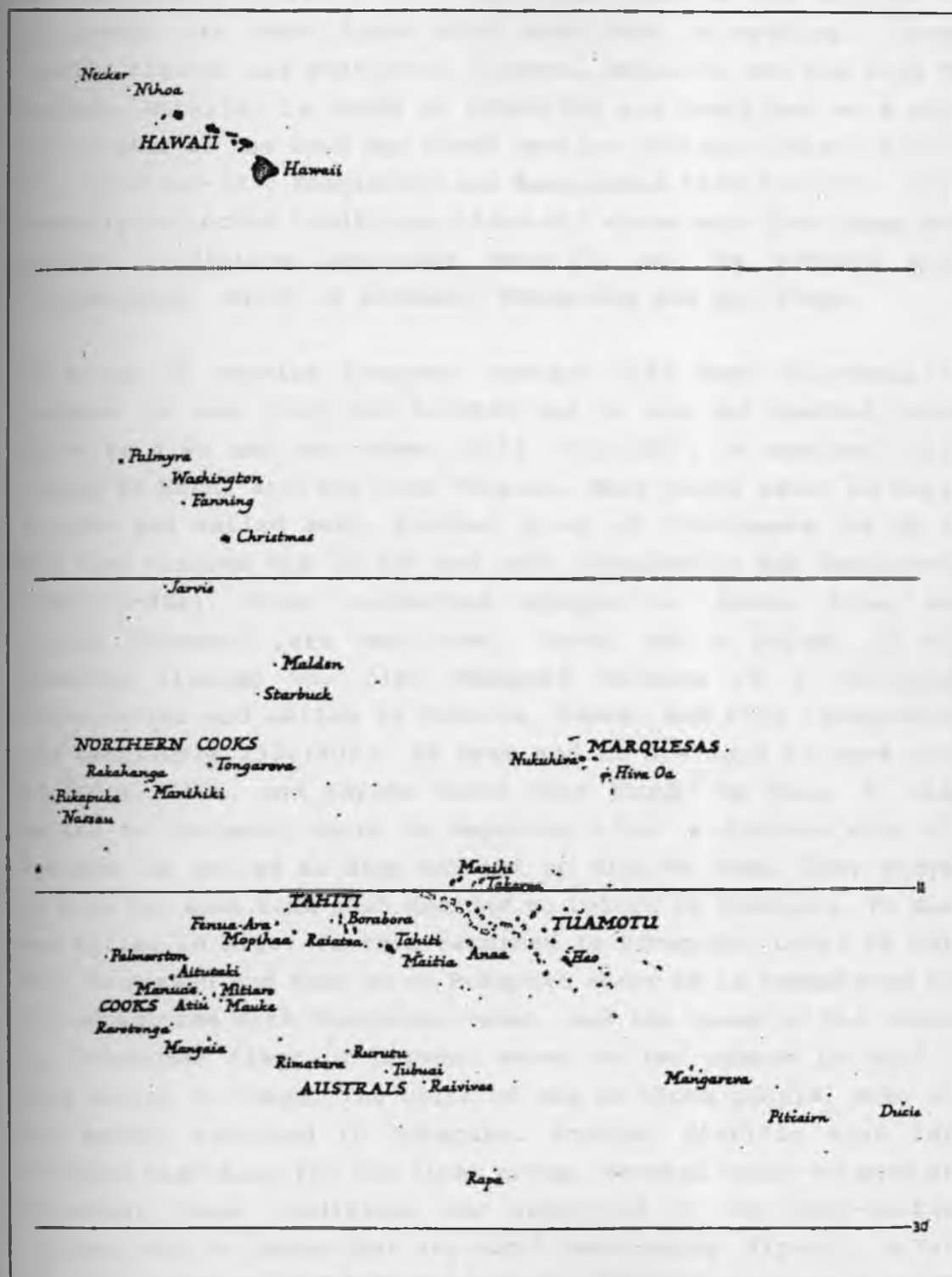


Figure 38: East Polynesia (Golson 1962:Inside Cover).

established. No Europeans lived there until the 1860s (Beaglehole and Beaglehole 1938:2-6, 17). The traditions of the origins of the people are embellished with much that is mythical. Three obscure figures are mentioned, Tamayei, Mataliki and his wife Te Vaopupu. Mataliki is dated at 20GB-1900 and described as a god, the creator of the land and first settler (Hutchin 1904:173-176; Gill 1912:122-123; Beaglehole and Beaglehole 1938:375-377). More recently collected traditions claim all three were from Tonga but earlier traditions associate Mataliki and Te Vaopupu with 'Tongaleleva' which is probably Tongareva and not Tonga.

In a mix of stories frequent contact with West Polynesia is claimed. In one story Kui drifted out to sea and reached Samoa where he died and was eaten (Gill 1912:123). In another drift voyage Te Mutui arrived from Tokelau. Many years later he built a canoe and sailed away. Another group of Tokelauans led by Te Amu also visited the island and left (Beaglehole and Beaglehole 1938:378-384). Other deliberate voyages to Samoa, Niue, and Vatuna (Futuna?) are mentioned. Yawau was a priest of the Yamaunga lineage who fled Pukapuka because of a religious indiscretion and sailed to Tokelau, Samoa, and Fiji (Beaglehole and Beaglehole 1938:402). Te Nana and Yi are said to have gone to Tonga, Niue, and Yayake where they fought Te Palo. Yi also sailed to Tonganui where he departed after a dispute with the Tongans. He sailed to Niue and met up with Te Nana. They stayed in Niue for some time then decided to return to Pukapuka. Te Nana was killed in Niue. Yi then returned to Pukapuka. Later Te Palo went to Nassau and then on to Pukapuka where he is remembered for his adventures with Pukapukan women, and the speed of his canoe. One Pukapukan fleet of between seven to ten canoes is said to have sailed to Tonga. The child of one of those people, Moko and his mother returned to Pukapuka. Another flotilla also left Pukapuka searching for the first group. Several other voyages are recorded. These traditions are supported by two post-contact voyages made to Samoa that are worth mentioning. Yipouli, a Yato man, after being labelled as a thief sailed by the star Melemele (Antares) and reached Tutuila. He later went on to Upolu where

he settled and eventually died. In the time of Okotai, a Rarotongan missionary, his son decided he would like to go to Samoa where he had lived with his father when he was young. Ten other men joined him and they sailed a borrowed canoe to Tutuila (Beaglehole and Beaglehole 1938:402-409). The Pukapukans used easterly trade winds to sail to Manu'a and monsoonal westerlies for the return home (Finney et al 1989:295). There is some confusion over the name Yayake or Yaiake which is variously associated with Rarotonga, Tahiti, Tonga and Samoa (Hutchin 1904:173-176; Beaglehole and Beaglehole 1938:378-383).

As expected there are frequent accounts of contact within the Northern Cooks Group. There is record of contact with Tongaleleva (Tongareva), and in particular one voyage reputed to have been made by 300 men on one canoe commanded by Luaivaipapa. The Pukapukans at one time controlled Nassau through a chief Ngalewu. Drift voyages within the group are also recorded such as one by two Manihiki warriors who arrived in Pukapuka. Contact between the islands ceased when conflict made sea travel dangerous (Beaglehole and Beaglehole 1938:381-393).

There are a great many accounts of voyages away from Pukapuka. The voyages claimed to the westward, towards the islands of Tokelau, to Tonga, Niue and Samoa are consistent with the traditions of Samoa, the closest of those islands, whose traditions also mention contact with the Northern Cooks. The early Pukapukan navigators made long sea voyages with a fair or even a beam wind, short voyages also with a head wind if the wind was mild and the navigator was clever enough to keep track of his position. That the Pukapukans were well aware of the difficulties of long voyages against a head wind during the hurricane season is shown by the fact that when they sailed to Upolu from Pukapuka they had a fair wind; coming back to Pukapuka, they did not attempt to sail direct (against the wind), but sailed first to the Tokelau Islands, waited there for the hurricane season, and, as is demonstrated by their star course, then sailed back to Pukapuka with a beam wind (Beaglehole and Beaglehole 1938:400-

411).

The sailing directions and routes, including star courses, and departure times are also retained in the traditions. Alpha and Beta Centauri were used to sail to Niue. When Alpha Centauri is at 209 degrees on the horizon and at five degrees altitude, the land bearing is 205 degrees which means simply, that the navigator would have to steer slightly more south. In another example, Orions Belt was used to steer for Olosenga in Samoa. Following Orion's Belt at fifteen degrees altitude and 264.5 degrees on the horizon gave a directional error of about seven degrees. However, a canoe would still pass within close enough proximity, just north of Manu'a, where observations of birds and land signs invariably guided mariners to their destination (Beaglehole and Beaglehole 1938:351-353).

That voyaging within the group ceased because of an increase in conflict contradicts the popular belief that over-population encouraged voyaging. It would seem that as populations increased there was a greater likelihood that new arrivals would be killed. Most other Polynesian traditions also tend to support the view that more long distance voyaging occurred during the earlier settlement phase.

The Traditions of Rakahanga and Manihiki

Rakahanga and Manihiki are 650 miles north of Rarotonga (See Fig.38). The turn of the century population was less than 1,000. European contact began late, in about 1820. The population was mostly converted to Christianity by 1850 by the survivors of a drift voyage (Hiroa 1932b:1-11).

The discovery of Rakahanga is obscured by myth. Stories of Huku bringing people to the islands are interpolated with those of three Maui brothers going fishing and pulling up the islands. Some state Whakahotu was the first person and both figures are

interconnected. Huku is often said to have come from Rarotonga and to have made several return voyages there. Another man Wheatu heard of Huku's discovery and landed first at Manihiki then at Rakahanga but was driven off by Huku. Huku returned to Rarotonga where he left his sister Tapairu and her husband Toa in charge. No more was heard of Huku. The genealogies begin with Toa and his wife. Huku and Tapairu may have been children of Hiro from Tahiti. Alternatively, Tapairu may have been his granddaughter. Toa arrived about 20GB-1900. Huku and Toa are known in Atiu, Aitutaki and Rarotonga (Gill 1915:144-151; Hiroa 1932b:14-23).

Other voyages are mentioned but few are very clear except for one concerning a young man who is said to have sailed to Samoa, Pukapuka and other islands (Gill 1915:151; Banapa 1920:88). An interesting aspect of these traditions and those from Pukapuka is that the names of the canoes are more often remembered than is the case for West Polynesian traditions although why this is so remains unclear.

The Traditions of Tongareva

Tongareva is the largest and furthest north of the Northern Cooks (See Fig.38). The twentieth century population was less than 1,000. First European contact occurred in 1788, although contact was limited until 1850s. Much tradition is recorded in Land Court records and in early manuscripts. A Bishop Museum expedition visited in 1929 (Hiroa 1932b:4-9).

Takatu is the earliest immigrant mentioned in the three main lines of genealogical descent. Taruia is the second and Mahuta the third. Taruia came from Savaiki and left one of his sons, Titia. An Aitutaki tradition states that Taruia was an ariki from that island who was deceived by Ruatapu into making a journey while Ruatapu supplanted him as ariki. Another figure Mahuta, is said to have been guided there by Taruia and later went to Tahiti. The Tongarevans are descended from his daughter by his

first wife and from the children of his second wife Hotio. Mahuta and Taruia appear on average 18GB-1900 (Hiroa 1932b:17-20).

The traditions of the Northern Cooks describe a scenario of limited voyaging east and south to Tahiti and Rarotonga and frequent voyaging westward to Samoa, Tonga and Niue. The westward connection seems reasonable enough given that getting there would be easy before the trades and the return easier than the easterly reach to Tahiti because of its shorter length and because seasonal westerlies would be more frequent and stronger. Broadly speaking a contact range east to west extends more than 1,200 miles from Tahiti to Samoa. It is also significant that both deliberate and drift voyages are described. Certainly Polynesians seemed to be as fallible as anyone else. However, stories about deliberate returns after an initial misadventure are also mentioned regularly. This is consistent with the traditions of the Polynesian Outliers and West Polynesia as outlined in Chapter Ten.

The Southern Cook Islands

The Southern Cook Islands include Atiu, Aitutaki, Rarotonga, Mangaia, Mitiaro, Mauke and Manuae. The centre of this group is 600 miles southwest from Tahiti, and 800 miles east of Tonga (See Fig.38).

The Traditions of Rarotonga

First discovery is credited to the mythical Tongafiti whose West Polynesian origin is generally assumed. The great road Te Aranui-o-Toi is associated with the name of Toi, considered to have lived there before the main genealogical ancestor Tangi'ia. There is strong evidence that Tangi'ia came from the Society Islands. Karika another ancestor is said to have arrived from Manu'a in Samoa (Te Aia 1893:273-274; Manuiri 1896:142-144; Fraser 1897:72-

73; Duff 1974:9-10; Parker 1974:63-67).

As discussed in Chapter Ten Rarotongan tradition has been substantially altered since contact with Europeans. Broadly speaking those reconstructed traditions are now divisible into three parts. The first part concerns the settlement of West Polynesia and the migration into East Polynesia; the second the settlement of Rarotonga itself, and the third part involves an assortment of figures who have been adopted from other, mainly East Polynesian traditions.

The first group includes mention of ancestors who reputedly voyaged far and wide and are claimed to have lived between 30GB-1900 up to 115GB-1900. One is Tutarangi who supposedly conquered Fiji, Tonga, Uvea and islands of Western Polynesia. Another is Uiterangiora who is associated with the early voyaging period from West Polynesia into East Polynesia. It is claimed that he visited more than eighty islands ranging from Indonesia, Vanuatu, Fiji, Tonga, Hawai'i, the Marquesas, Society, Austral, and Cook Islands and New Zealand (mentioned as Avaiki-tautau). It is also said that he voyaged into sub-Antarctic waters. Several generations later Te Arutanganuku is said to have retraced his voyages including his venture to the deep south. However, the text referring to that voyage is disproportionately long when compared to the overall tradition. It is likely invented. Other very early East Polynesian pan-Pacific navigators such as Ka'ukura, Maru, Paa and Apa are claimed (Nicholas 1892:20-25; Stair 1895b:100-103; Smith 1910:155-235; Te Arikitarare 1919:63-67, 137-143). These appear to have been selected from disparate traditions and merged together in an attempt to construct a comprehensive Polynesian history. The earlier traditions concerning the peopling of West Polynesia are also questionable because many of the events said to have occurred there do not appear in the traditions of any of the islands or island groups in that region.

The main body of Rarotongan tradition deals with the founding

ancestor Tangi'ia, or Uenga, who lived about 26GB-1900. He was adopted with his cousin Tutapu, also known as Tutapuaruroa (Tutapu the relentless pursuer). They entered into a dispute over land in Tahiti, and this led to war. Tutapu went to Iva whilst Tangi'ia is attributed with having made voyages from Tahiti to the Southern Cooks, Avaiki (reckoned to be Savai'i in Samoa), and many other islands. He was later also driven out of Tahiti by Tutapu and returned to Avaiki where he was given directions to Tumutevarovaro (Rarotonga). He departed via U'ea, Upolu, and Iiti (Fiji) where he met the famous navigator Iro (Whiro). He later voyaged to Rapanui (said to be Easter Island), Mo'orea and Uaine (Huahine), Porapora, Ra'iatea and even to Fiji, all the while being pursued by Tutapu. Finally he met Karika near Mauke and after forming an alliance they headed for Rarotonga. Some time later Tutapu arrived and eventually he and a great number of his men from Iva were killed (Nicholas 1892:25-29; Te Aia 1893:276-277; Stair 1895b:103-106; Smith 1910:188-253; Gill 1911:203-209; Te Arkitaraare 1919:186-197; Te Uira 1928:115).

Sixteen of the major voyages attributed to Tangi'ia total about 18,360 nautical miles. An overall a range of voyaging of over 5,500 miles between Papua New Guinea and Easter Island is claimed. This contact area should more correctly be reduced to include the Southern and Northern Cooks, and the Society Islands with perhaps some voyages into the Tuamotus and Marquesas. Many of the names of voyaging destinations such as Vava'u, Hiva, Upolu, and Avaiki have been interpreted as West Polynesian, Tuamotuan and Marquesan destinations. However, all are place names within the Society Group itself, where Tangi'ia is said to have originated. Avaiki could equally be Ra'iatea, and Vava'u, Borabora. Hiva need not be the Marquesas as Hiva is also a clan name from Ra'iatea and Taha'a. Uiterangiora is credited with sailing to Enuamanu, referred to by Smith as Papua New Guinea yet Enuamanu is also an earlier name for Atiu. Rapanui is also clearly a post-contact name. It seems that when these traditions were being collated into a comprehensive Polynesian history, the location of place names was stretched as far as possible. Perhaps

it was thought that this might add more prestige to them. Certainly no other traditions, other than those included in Smiths (1913, 1915) The Lore of the Whare Wananga from New Zealand, claim such a comprehensive knowledge of Polynesian history.

Other Rarotongan traditions seem consistent with what is generally found in other Polynesian tradition. After Tutapu's death other arrivals were also killed including Ava and all of his people. Further immigrant expeditions led by Peinga, Ouruariki and Te Ikataurangi shared a similar fate (Nicholas 1892:65-75; Browne 1897:1-10). Ironui the famous navigator is known in Rarotonga.³³ Aitutakian genealogies show Iro as an ancestor of Tangi'ia while the Rarotongan version is that they were contemporaneous at about 27GB-1900 to 30GB-1900. Iro's son Taiteariki is said to have been adopted by Tangi'ia. Iro's parents are said to be from Vava'u and Kuporu in West Polynesia, which, to reiterate an earlier point, were probably islands of the same name found in the Societies. Iro is also credited with voyaging to Iva (said to be the Marquesas), Tahiti, and Enuakura and then returned to Iva where he stayed some years. In later life it is said he voyaged to many other lands including Rarotonga, Mangaia, Mauke, Atiu, and Avaiki-tautau, said to be New Zealand (Haweti 1916:-138-148; 1917 p10-58; Te Arkitaraare 1921:113-127). Significantly Iro and Tangi'ia are not mentioned in the traditions of West Polynesia.

The Traditions of Atiu

Atiu is about 130 miles from Rarotonga (See Fig.38). Its earlier name was Te Enuamanu, the bird land. Traditions concerning first settlement are unclear except that Utatakienna, also an ancestor for Aitutaki, came to Atiu from the sea. Apparently Atiu was already occupied and ruled by Tutuaiva, who fled to Rarotonga.

³³ Whiro in New Zealand, Hilo in Hawai'i, Hiro in Tahiti.

Utatakienna established himself on the island by killing the previous occupants. The tenth ariki in descent after Utatakienna was Tukuata whose grandson reputedly led a fleet of eighty canoes to Mauke to make war. Years later another punitive expedition was organised and Mauke re-conquered. In another tradition, Rongomatane conquered Mitiaro and the three islands became known jointly as Ngaputoru. According to Atiuan tradition they were in contact with Rarotonga and other islands lying to the westward, and with Tahiti and other islands lying to the east. Tangi'ia, the noted Rarotongan navigator is also known. Rongomatane was alive when John Williams a missionary visited the island in 1823 (Large 1913:67-76; Duff 1974:87-93).

The Atiuan traditions narrate a primary close contact zone extending 150 miles northwest to southwest, from Atiu, through Mitiaro to Mauke. Infrequent secondary references are made to Rarotonga to the southwest, and Tahiti 500 miles to the east which would indicate that most voyaging was local. Groups composed of smaller islands tend not to have traditions of long distance voyaging. This may be because they did not have the resources required to launch frequent long distance voyages. Their size may also have increased the difficulty of making a return because they presented such small targets to aim at. It also seems to be the case that the East Polynesians did not have the same opportunities to exploit seasonal westerlies as the West Polynesians had. This made eastward voyaging difficult.

The extent of the voyaging described is consistent with the pattern described in the Northern-West Polynesian islands. Those groups of smaller islands share a similar geography.

The Traditions of Aitutaki

Aitutaki lies on the northern edge of the Southern Cooks (See Fig.38). It was originally named Araura by Ru, the first settler said to be from Avaiki. He heads a largely mythical eleven

generation genealogy the names of which all begin with Ru. A second settler Te Erui and his brother arrived in 29GB-1900 and were also from Avaiki. They displaced the people of Ru and took possession of the land. Reputedly they had also fought against the people of Ati Iti and Atu Tonga, said to be Fiji and Tonga (Pakoti 1895:65-67; Gill 1911:149-151).

Iro, the famous East Polynesian navigator, was also known on Aitutaki. His parents were Moeterauri and Akimanokiatu from Enuamanu or Atiu. Iro grew up on Aitutaki and lived in 31GB-1900. He is reputed to have sailed westward to Vava'u. Tangi'ia is also known and dated at 24GB-1900 to 28GB-1900 (Large 1903:133-146).

Another famous East Polynesian navigator Ruatapu is said by some to have come from the west, and by others to have come from Tahiti. He sailed first to Rarotonga and Mauke, which suggests he probably came from the east, where he made war and exterminated the people for killing one of his sons. He then went on to Atiu, Manuae and finally to Aitutaki where he married Tutunoa. Their son was Kirikava who had Maevakura. Ruatapu removed the ariki Taruia and installed himself as ruler where he remained until his death. Taruia is said to have gone to Rapukatea (Tongareva). In another story, Kirikava voyaged to Tahiti where he challenged the champion Tuotakura to a wrestling match which he lost. Years later his nephew Te Aunui, also went to Tahiti where he avenged the defeat of Kirikava. At one time Aitutaki was overrun by men from the east described as the Aitu clan. Maevarangī, a descendant of Ruatapu, sent Marouna to Rarotonga and Mangaia for aid. Marouna is said to have gone to Mauke, Nukuroa (now Mitiaro), Te Enuamanu, and Te Tapuaemanu (now Manuae) recruiting as he went. He also went to Niue where he recruited Titia. Returning to Aitutaki the Aitu clan was defeated and Marouna became ariki (Low 1924:171-186, 258-266; Large 1906:209-219; Pakoti 1895:67-70; Smith 1902:79-218).

The traditions of Aitutaki are generally consistent with those of Atiu. They speak of frequent contact between the islands of

the Southern Cooks and infrequent contact outside the group with Tahiti. The connection with Niue is interesting as it lies only 450 miles to the west. Perhaps this was another passage similar to the Pukapuka-Samoa voyage linking West and East Polynesia. Because of the large number of islands claimed to have been visited by Marouna during his voyage, the mention of Niue may be post-European.

The Traditions of Mangaia

Mangaia is the island farthest south in the Southern Cooks, 110 miles east of Rarotonga (See Fig.38). The early twentieth century population was less than 2,000. A Bishop Museum expedition went there in 1929 to 1930. Missions were established in 1823. Several missionaries recorded much of the history and song from men born before 1800 (Hiroa 1934:1-7).

According to Mangaian tradition Rangi, Te Akatauira, and Mokoiro were the first settlers. They are not associated with any canoe or migration. However, it is surmised that Rangi and his people were part of Tangi'ia's migration from Tahiti to Rarotonga (Hiroa 1934:19-21, 31-33). Consistent with regional contact, figures such as Tangi'ia and Tongaiti are known. During the period of Rangi a fleet of canoes landed on the south side of Mangaia at Tamarua. The people were called Tongaiti. A series of wars followed. Eventually the new arrivals were allowed to stay. Gill (1876:287) surmised that they were driftaways from Tonga but there is no evidence for this other than the term Tonga itself. After the arrival of the Tongaiti, another group arrived from Iti (Tahiti). In one story Tangi'ia of Rarotonga sent his sons Mоторо, Ruanuku, Keretekii, and Utakea to Mangaia (Hiroa 1934:31-37).

The traditions from Aitutaki, Aitu, Mitiaro, and Mauke show that waves of people from Tahiti descended upon the islands and fought with the people already in occupation. They were everywhere

alluded to as the Aitu or Ngati Tane (worshippers of Tane). On Mangaia they were wiped out by Tamatapu. In another tradition 200 warriors on a fleet from Rarotonga also invaded Mangaia. Invasions from Aitu and Aitutaki are also recorded (Hiroa 1934:37-40).

Except for the major Rarotongan reconstructions discussed in Chapter Ten, the traditions of the Southern Cooks are very consistent. They talk about continual contact within the group over an area about 200 miles long and 300 miles wide. Contact with Tahiti 600 miles to the northeast is certain. Contact with Tongareva and the Northern Cooks 600 miles to the north also seems likely, although the voyage of Taruia appears forced. Except for contact with Niue, and possible very early settlement voyages by the Tongaiti little contact with West Polynesia is likely. The stories about regular contact by Whiro and others with West Polynesia are unlikely and probably reconstructions.

The pattern seems consistent for the traditions of an island group. Most contact occurs within the group and more intermittent contact occurs with other reasonably accessible island groups.

The Southern Belt

The Southern Belt comprises the Austral Islands, Rapa, Mangareva and Easter Island. The Australs lie 400 miles south of Tahiti and 600 miles east of Rarotonga. Rapa is isolated a further 250 miles southeast. Further east is Mangareva and beyond there the farthest island east, Easter Island (See Fig.38). First European contact occurred in 1769 (Hiroa 1945:88-89).

The Traditions of Tubuai and Rurutu

Three traditions from Tubuai refer to voyages made to Raivavae about 100 miles southeast (See Fig.38). One Eva'ari'i went to

Tubuai where he married two women. After a dispute with his father-in-law he went to Raivavae where he married Hairitemarama Vahine. Naraitane left Raivavae and went to Tubuai after assaulting his daughter-in-law. In another story Te Uahau and Moeava departed from Raivavae in separate boats. Teahia, a man who had drifted from Tubuai to Raivavae, accompanied Moeava. Moeava went to Rurutu and then departed there and was not heard of again. Teuahau settled at Tubuai after Teahia begged the locals not to attack them. In another important account Matauira from Tubuai, recruited Haatauhi said to be from Borabora in the Society Islands, and went to challenge a warrior of Rurutu named Ututoa. He was subsequently killed (Aitken 1930:5-6, 110-113).

Consistent with other groups these traditions speak mainly of contact within the group and infrequent voyaging 300 miles north into the Society Islands. There is a tradition of Tute from Rurutu who is said to have voyaged throughout the Society Islands, Tuamotus, and to Mangareva and Easter Island (referred to as Raparahi). Reputedly he conquered several of these islands. Tangi'ia and Ka'ukura also appear in this story (Gill 1911:136-143). This tradition was collected by Rarotongan missionaries and reconstructed elements were likely included by them.

The Traditions of Rapa

Rapa is 450 miles southeast of Tubuai and 680 miles southwest of Mangareva (See Fig.38). Traditional records are scant. The last traditional ruler was Parima a regent for Pomare I of Tahiti lying 600 miles to the northwest. This is confirmation of the records from the Northern and Southern Cooks and the Australs that Tahiti had contact with islands and groups on her periphery. In other traditions Hoturapa fled Rapa with three canoes, one of which made safe landfall on Easter Island. Rapanui was already inhabited. The newcomers then exterminated all the men. This is said to have occurred 22GB-1900. Recurring contact between Rapaiti and Rapanui is claimed. One drift voyage from Easter

Island to Rapa is claimed. Other links are thought to have existed with Mangareva and Rarotonga (Smith 1910b:171-175).

The Rapanui story is consistent with Easter Island traditions, although it remains uncertain whether this is the result of post-European reconstruction.

The Traditions of Mangareva

Mangareva is 900 miles from Tahiti and 1,450 miles from Easter Island (See Fig.38). The four habitable islands are Mangareva, Taravai, Akamaru and Aukena. It was first sighted by Europeans in 1687, and then again in 1797. Missionaries arrived in 1834. A Bishop Museum expedition visited in 1934. An early indigenous manuscript exists from 1856. As for the Tuamotus much traditional material seems to have remained intact (Hiroa 1938:3-14, 96-99).

One origin story mentions Miru and Moa arriving and finding the islands uninhabited. Another has Tagaroahurupapa as the first settler. First definite settlement occurred 26GB-1900 by Tururei although few details are retained in the traditions (Hiroa 1938:18-21).

During its early history frequent voyages to and from Mangareva are recorded. A generation after Tururei, Te Tupua and Hua arrived from Rarotonga where they had been driven out by Epopo. Later Te Tupua and others returned to Rarotonga to assist him regain his lands. Keke arrived from the west in 24GB-1900. Taratahi arrived in 23GB-1900 but was eventually forced out for his tyrannical behaviour. Auamotua, who lived 22GB-1900, had a son Te Agiagi who proposed a voyage to Te Matakiteragi (Pitcairn). Puniga and Marokura were the navigators. The canoe is recorded as going too far southeast into cold seas. Te Agiagi took over the navigating and successfully located the island where his grandfather Taratahi was living. Some time later Ragahenua arrived at Te Matakiteragi where he fought with the

people of Puniga and Marokura. Two canoes fled the island and returned to Mangareva. In 21GB-1900 a canoe arrived from Ruapou commanded by Ogaakuranui to trade in red fathers. Other arrivals from the west are recorded. Then in 19GB-1900 Tapaunui fled Mangareva for Hiva after losing in war at a time when rivalry between families, islands and tribes was causing constant fighting. During subsequent generations double hulled canoes were increasingly used for warfare between the islands. The traditions mention less about voyaging until 15GB-1900 when another canoe under Tukairoa arrived. He later left with a cargo of basalt rock (Hiroa 1938:21-46). This last story is interesting in that Tukairoa's arrival is more cautiously treated because of the constant fighting. Genealogies are exchanged before he is accepted. This practice is also noted in the traditions of the Tuamotus and other East Polynesian islands and seems to be related to an increase in population, competition over scarce resources and localised warfare. It tends to contradict the view that over-population caused migratory voyages to take place, on the contrary more voyaging seems to have occurred when the population was lower. These traditions are also consistent with those from the Northern Cooks where the decline in voyaging within the group is explained as being due to warfare, and the likelihood of being killed upon landing.

Wars continued into subsequent generations, with famine and drought contributing to the struggle. Rafts and fishing canoes seemed to be used more often than double canoes. This seems to be because the canoes are associated with war and because there was little respite required for their construction. From 14GB-1900 to 9GB-1900 several exiles leave on an assortment of rafts and canoes after being defeated in war. In 8GB-1900 Ragai arrived from Hiva and reported that earlier exiles under Rogo had successfully settled in the Tuamotu's (Hiroa 1938:46-82). When Europeans arrived they reported seeing the wrecks of the last canoes which had been broken up about 1800 (Hiroa 1938:287-289).

The Traditions of Easter Island

Easter Island is located 1,600 miles from Mangareva, 1,100 miles from Pitcairn, and 2,300 miles from the South American coast (See Fig.38). The pre-European population was estimated at between 3,000 to 4,000. In 1872 there were only 111 survivors left after disease epidemics, and raids by Peruvian slavers. Bishop Museum fieldwork was carried out during 1934 and 1935 at which time it was recorded that most of old traditions had disappeared. Easter Island was named for Easter Sunday by the Spanish in 1722 at first contact. The name Rapanui first appeared in 1864 and is of recent origin. The names Te Pitotehenua and Hitiairangi are probably the original indigenous names. The first missionary arrived in 1863 (Metraux 1971:9-44).

The first immigrants came from Maraerenga or from Maretoehau. There is a general consensus that these ancestors came from the west. Hotumatua was a king on Maraerenga and had succeeded his father Te Ririkaatea. Hotumatua left that island because of a dispute with his brother. He was defeated and obliged to go in search of a new country. All versions agree that Hotumatua was not the first person to land on the island and that he had been preceded by six men who were sent ahead to reconnoitre the island. Hotumatua fled in two large canoes ninety feet long and six feet deep. Some of the traditions mention in a vague way that other people were already present on the island. One version at least speaks of a return journey. Tuukoihu is mentioned as another important figure who arrived with Hotumatua (Metraux 1971:55-64).

The traditions carry on to speak of a war between two peoples or tribes known as the 'long-ears' and the 'short-ears'. There are no clear explanations of these tribes. Some say both the long-ears and short-ears may have arrived with Hotumatua, although others claim the two were separate races who divided the island among themselves. One source attributes the building of the

monuments to the long ears and says that they lived there previous to the Polynesian immigration. The suggestion is not unreasonable, that it may refer to an earlier population, but the concept is rather speculative; the evidence at best thin. Certainly there are traditions of wars between Hotumatua's son and the people of Tuu (Metraux 1937:44; 1971:69-74).

There is some speculation that the Easter Islanders may have reached South America because of the similarity of their statues with South American examples. Others have claimed the Easter Islanders were descended from the Maori. Certainly a connection with Rapaiti is suggested because of the Hoturapa story (Smith 1910b:171). As with Hawai'i the traditions concerning voyaging are short and brief. Obviously distance has much to do with this, although not necessarily in the sense that voyages over long distances were impossible, but rather that they presented a range of difficulties not restricted to the actual navigation.

The Eastern Islands

For the purposes of this study the islands of Hawai'i, the Societies, Tuamotus, and Marquesas are grouped together. Their traditions speak of contact at different times with the Society Islands as the central hub.

The Traditions of the Society Islands

The islands comprise Tahiti, Mo'orea, Huahinenui, Huahineiti, Ra'iatea, Taha'a, Borabora, Tupai and Maupiti. The group lies 400 miles northeast of Rarotonga (See Fig.38). First European contact occurred either with Quiros in 1606, or Wallis in 1767. Much early material was collected by Rev. J.M.Orsmond between 1820 and 1834 (Henry 1928:1-6).

The traditions speak of a maritime dynasty called Hui Ari'i,

which traces its descent from Ta'aroa who conquered an older population called Manahune. Contact within the archipelago was frequent and only requires a brief mention. Borabora's ancient name was Vava'u and its most famous warrior Te Iva. It was known for its great naval record and its conquests over Rai'atea, Taha'a and Maupiti. An alliance between Tahiti, Huahine, Ra'iatea, Maupiti and other islands superseded the power of Borabora. Later Tahiti, Ra'iatea and the great marae of Taputapuatea became the main cultural and political centres. Some generations after this Pomare I conquered the Society and Tuamotu Islands. He lived about 5GB-1900 (Henry 1928:128-131, 247-267; Handy 1971:75-100).

Contact with other island groups is also noted in the traditions. Contact with the Tuamotu's is notably recorded in the records of the exploits of Pomare I. One Tuamotan chief attempted to take possession of several islands lying to the south and east of Tuamotu, being Ni'au, Toa'u, Apataki, Ka'ukura, Arutua, Rangiroa, Tikahau, Makatea, and Matahiva. Pomare I ended that strife by annexing all of the Tuamotus. He sought and obtained a political meeting at Papa'oa where he and his statesmen met those of the Tuamotu islands. Two Tuamotuan kings were to retain their titles and dominions under his overall authority and Tahitian viceroys were appointed. Many men from the Tuamotuan islands served with Pomare. They were reputed navigators and sailors with a noted knowledge of geography and astronomy (Henry 1928:106-113). Contact with Mangareva is recorded in a tradition concerning Huritemonoi the beautiful daughter of Mahu and Toaehau. The four sons of Manua of Tahiti voyaged to Mangareva to seek out Huritemonoi (Henry 1928:607-611). The canoe returned to Tahiti and Huri was married to the youngest brother Tui.

Of more ancient navigators, one of the most famous is Hono'ura who led an expedition into the Tuamotus, including his three younger brothers and Ta'ihia (Tangi'ia), to seek vengeance against Tuamotuan raiders led by A'uroa. He defeated the Tuamotuans at Rai'atea. A'uroa escaped and returned to Hiva in

Papatea where Tutapu was king. Hono'ura pursued him and during the subsequent fighting Tutapu was killed and the Tuamotuans defeated. In some versions Ta'ihia was killed and in others he was wounded. The Tahitians kept searching for Te A'uroa voyaging throughout the Tuamotuan islands and on a second expedition managed to kill him (Williams 1895:256-294; Gill 1896:125; Henry 1928:515-532). This tradition was recorded before 1825. The language is said to be so archaic that the Tahitians themselves were not sure as to much of its meaning.

Hiro is also well known throughout the Societies. He is said to have been born on Uporu (Taha'a), the son of Moeterauri of Borabora and Faimano. In another version his father is said to be Hirora'amauriri. As a man he is said to have acquired a passion for stealing, womanising, navigation and visiting different lands. It is said that he sailed to the Marquesas and Hawai'i, and the Austral islands as far as Rapa. He was also a skilled canoe builder, and is said to have been the first to build large canoes with planks sewn together. He is known for one incident when he killed his wife. After this he built a canoe named Hohoio (interloper) which was dedicated to Tane. The canoe was launched and provisioned with bamboo baskets of fish, attached to the outside of the canoe so as to be in the water. Hiro sailed out and never returned to Tahiti (Henry 1928:537-552).

Turi, the New Zealand West Coast ancestor, is also known. He is said to have been born at Mahaena and married Hinarau. Because of his jealousy of her, and her disobedience of him, he left Tahiti. Another account records that he got into trouble over a woman at Rai'atea and was forced to leave. In both accounts he is never heard of again. A third account claims he was born at Fa'aroa. He had his own, mountain-named Faneufi, and two canoes. His wife's grandfather was Hoto or Toto. The account also says that he left and never returned (Smith 1910:266-269). There is a possibility that the stories of the Tahitian Turi may have been altered slightly to bring them into line with those of the New

Zealand Turi. The current writer was unable to locate the reference.

Other traditions may have become more embellished with additional material since European contact. One Te Fatu is said to have gone from Rotuma to Porapora. He was received into the royal house of Porapora and married a woman named Te'ura. He is reputed to have voyaged throughout the Society and Austral Islands, and even to Rarotonga and Te Aotearoa (Henry 1928:118-264, 607-611). In another oddity Tangi'ia's canoe is referred to as *Tainui*. Knowledge of the New Zealand *Matatua* is also claimed (Salmon 1910: 43-46).

Navigators from the Society Islands voyaged throughout their own group of islands and into the Tuamotus on a regular basis. This central area of contact is nearly 700 miles wide and 1,000 miles long. Reasonable claims are made of less frequent voyaging into the Southern Cooks and the Austral Islands, which lengthens the contact zone up to 1,500 miles. It does not seem unreasonable to suggest that intermittent contact occurred with Hawai'i, Mangareva and the Marquesas. The Society Islands were probably the centre of East Polynesian voyaging with other groups extending the overall contact area by virtue of being on its periphery.

Generally the East Polynesian traditions mention much inter-island group voyaging between 20GB-1900 to 30GB-1900. This does not mean that subsequent contact occurred on a continuous or concurrent basis. It is likely that contact between larger island groups and Tahiti varied in extent. For example, immediately prior to European arrival Tahiti and the Tuamotus were in frequent contact but Hawai'i and Tahiti were not. This scenario seems consistent among most of the traditions in the region.

The Traditions of the Tuamotu Islands

The seventy-eight islands of the Tuamotu chain are spread over an area 900 miles long by 300 miles wide (See Fig.38). A Bishop Museum expedition there in 1929 to 1930 recorded genealogies containing thousands of personal names, and the names of 70 historical canoes and their captains (Danielsson 1967:11). Because of the dangers of sailing among the reefs of the Tuamotus European influence was negligible until well into the twentieth century (Hiroa 1945:85).

Generally the origin traditions are obscure. However, on Napuka the first navigators to land there are well recorded as Kiore, Mahinui, Tutavake and Te Uhi. Mahinui lived arrived in 12GB-1900. The royal genealogy begins with Tutefa 9GB-1900 and ends with Taki (Aubran 1918:132-133; Emory 1940:69). In another tradition Pere, from Fakarava island, formally called Havaiki, is said to have voyaged to Tahiti (Young 1898:109).

On Fakahina the first settler is recorded as Te Maputeagiagi who migrated there 10GB-1900 from Mangareva. It is said that his people settled on Reao, Pukarua, Takoto, Vahitahi, Hao, Fakahina, Fagatau and Hikueru. There is a tradition of another Mangarevan canoe arriving (Aubran 1918:161-165). Apparently there was much tension when they arrived but after hailing each other and exchanging genealogies they were allowed to stay. This practice seems consistent with the Mangarevan traditions.

Much is retained in the traditions of Fakahina about voyaging. One Makere was famous for his liaisons with women on Fakahina, Takume, and Fagatau. Te Fakahira was known for his love of long and dangerous voyaging and visited many islands within the group such as Takoto, Reao and Hao. He is also attributed with having voyaged to other islands outside of the group. Te Mauri, the son of Te Fakahira, born at Hao and taken by his father to Fakahina, was also a romantic adventurer known in many islands. Faruia,

remembered as an athlete and a colossus, voyaged to Vairatea (Rai'atea) where he was eventually killed. Maruake, a more recent navigator, went to Takoto and tried to seize the wife of Porutu who struck him down. He returned to Fakahina wounded and bleeding and later formed an alliance with people from Takume and Rairoa. He later returned to Takoto killing many of the islanders, including Porutu. He seized Porutu's woman and took her back to Fakahina (Audran 1919:232-236; Stimson 1932:190).

One great Tuamotuan navigator was Moeava who lived about 20GB-1900 or earlier and was born at Takaroa. His wife was from Napuka. When absent from Takaroa the island was attacked by a confederation from the western and central islands of the Tuamotu group including Rangiora, Ka'ukura, Kauehi, Apataki, Fakarava, Makemo, Anaa. When Moeava learned of the massacre at Takaroa he systematically attacked all the islands of the Tuamotu Group who had assisted in the massacre, until all were brought under his domination (Audran 1918:26-35, 1919:31-37).

Arrivals from outside the group are also known. The earliest remembered visiting canoe was from Nukuhiva in the Marquesas. Another arrived from the west with Manavarere as captain about 10GB-1900. His crew were massacred and decapitated. Manavarere survived only to be tortured. He was eventually spared and released. Arrivals by drift voyage are also known. People from Hiva (The Marquesas) were said to be feared and invariably killed. Such arrivals are recorded as being killed on Ngake and Fagatau. Another to arrive at Hao Island was Hitiraumea who possessed the peculiarity of having a little hole under each ear (Audran 1918:90-92; 236-239).

The Tuamotuan traditions show frequent contact along the length of the archipelago. Less frequent contact is cited with the Marquesas, Mangareva and the Society Islands although the latter two seem to be very well known. The wider contact area is nearly 1,100 miles long and 850 miles wide.

The traditions of new arrivals being killed are consistent with those from the Northern Cooks, Rarotonga, and Mangareva.

The Traditions of the Marquesas

The Marquesas islands are spread out in an island chain 250 miles long, the centre of which is some 300 miles northeast of the Tuamotus (See Fig.38). The principal islands are Hiva Oa, Tahu Ata, Fatu Hiva, Ua Huka, Ua Pou, and Nuku Hiva. The islands are subject to drought which does not occur simultaneously due to variation in the height of mountains, and certain geographic and meteorological factors. First European contact was in 1595. A Bishop Museum expedition visited for nine months in 1920 and 1921. Much material was collected at the turn of the century. The early twentieth century population was about 1,800 (Handy 1923:3-5; Hiroa 1945:86-87).

One story is that the islands were once peopled by spirits who were later conquered. One early tribe the Fitinui were defeated in war and were said to have departed on bamboo rafts. They were driven southward and now people from Napuka in the Tuamotu islands claim descent from them. Early settlers mentioned throughout the group include Nuku, Tiu, Mo'ota, Mohuta, and Taupo. Nuku appears between 30GB-1900 to 60GB-1900 and is traditionally one of two brothers who were the first settlers on Hiva Oa. The latter four figures appear to have originated in Hiva Oa and later spread out to settle other islands (Christian 1895:191-192; Smith 1911:152-154; Handy 1923:10-20).

There were deliberate emigrations from the Marquesas because of expulsion in war, famine, drought and adventure. One story is about people who were forced to flee from Hanapa'aoa on a bamboo raft. They reached Takaroa in the Tuamotu islands. A similar story tells of people who fled Uauka in Nuku Hiva and were never heard of again. A more recent occasion was recorded in 1813 when four large canoes left in search of other lands which they

purported to know existed. Others had built canoes in preparation for a time when they may be driven from their land. Trade also seems to have taken place in search of a type of red parakeet whose scarlet feathers were highly prized throughout Polynesia. The Marquesans reputedly travelled as far as Rarotonga for the famous feathers (Handy 1923:10-21; Elbert 1941:74-83; Terrell and Langridge 1988:12-29).

Famous navigators who voyaged throughout the archipelago include Putio, Tutona, Tupa, Tanaoa, and Ono who went to the Tuamotu islands and later became ruler of Mohotani in the Marquesas. Another was Te Heiva who departed from Puamau in search of other lands. From Hivaoa he sailed to Nukuhiva, and then on to Te Fiti (Tahiti). Some remained there while others returned to Puamau (Handy 1923:23; Handy 1930:26-33, 78-131).

The Marquesan, Tuamotuan and Mangarevan traditions share much in common about forced voyaging because of war, famine and drought. The number of departures tends to agree with the high number of arrivals recorded by the Tuamotuans. Only a limited number of returns are recorded. The contact area extends to Tahiti 800 miles to the southeast.

The Marquesan traditions are also consistent with those from Uvea, Tonga, Mangareva, the Tuamotus and Southern Cooks where voyaging for trade in stone and feathers is mentioned.

The Traditions of Hawai'i

Hawai'i is part of an island chain 1,500 miles long. There are two main lines of genealogy. The chiefs of Maui and Hawai'i generally trace their ancestry to Ulu, and the chiefs of Kauai and Oahu to Nanaulu. Ulu and Nanaulu are probably cosmological figures. There are wide variations in the Hawai'ian oral tradition concerning their origins. An earlier population are sometimes referred to as the Menehune. This term is also known

in the Tuamotus, Tahiti, and Rarotonga (Malo 1898:14-24; Beckwith 1970:293-336).

The most definite early tradition is that surrounding Paa and Makuakaumana who sailed from Tahiti some sixteen generations after Kapawa (considered to have been a real person), during the reign of Lonokawai. Paa remained in Kohala while Makuakaumana returned to Tahiti. Later Paa made a return voyage to Tahiti and returned with Pili who became one of the kings of Hawai'i. A subsequent migration was led by Maweke. His son was Mulieleali'i whose sons were Kumuhonua, Moikeha and Olopana. Olopana settled on Hawai'i and married Lu'ukia. Later he returned to Kahiki where Moikeha was living (others say he was in Hawai'i with Olopana). Moikeha then departed for Hawai'i and members of his party, including several sons, settled on Oahu, Kauai, Hawai'i, and Maui. This occurred during the reign of Kalapana. Moikeha's son Kila went to Kahiki and brought back with him his brother La'amaikahiki who introduced the use of the drum (Malo 1898:25-28, Beckwith 1970:352-373). According to Tregear (1891:672) Pili was the thirty-seventh ruler before 1900, Lonokawai the thirty-ninth and Kalapana the twenty-seventh. One Kahai is said to have been the last voyager to Tahiti (Lyons and Alexander 1893:161-166).

There are two more doubtful traditions about immigrations to Hawai'i. One is that Hawai'inui from Kahiki sailed from there and settled Hawai'i (Beckwith 1932:58-76) The second concerns the story of Hawai'iloa (Beckwith 1970:363-365). Both stories are reconstructions, as discussed in Chapter Nine, and designed to explain original occupation in the absence of an appropriate tradition.

Other immigrant voyages of undetermined origin are also mentioned. Kukanaloe and Kaekae are said to have arrived in the time of Kakalaneo. Another canoe containing five persons was wrecked off Maui. One contained a woman named Wakalana. A third was brought back by an obscure navigator named Paumakua from one

of his voyages. Hono'ura, Hilo, and Ta'ihia are also known (Beckwith 1970:384-472).

Simply put the traditions of Hawai'i depict a short period of deliberate voyaging between Tahiti and Hawai'i more than 3,000 miles apart. The reason for the cession of voyaging is uncertain but distance, the strain on traditional materials such as sennit rope and pandanus leaf sails were likely causes. Given that both are large island groups not lacking in resources the lack of a sufficient motive for continuing contact may also have been a contributing factor.

Summary

Generally speaking the traditions of East Polynesia are consistent with those from West Polynesia. Both sets of tradition also seem consistent with the archaeological material concerning 'homeland regions' presented in Chapter One. No island group seems to have clear traditions about original occupation. 'First arrivals' are nearly always first most well remembered arrivals. The populations of the original inhabitants may have been too small to have retained record of themselves over an extended period of time. Secondly, their records were probably mostly lost after subsequent arrivals.

In terms of voyaging each group maintained contact with its closest neighbours although the smaller groups such as the Australs and Northern Cooks did so on a less frequent basis. Each group also had intermittent contact with other island groups. The centrally placed Society Islands seemed to have had the most contact with surrounding groups and are suggested as a major centre for maritime activity. Nearly every other group in the eastern Pacific was in contact with the Societies at some stage.

The overall contact area forms an eastern triangle with Hawai'i at apex, and runs 1,800 miles to the end of the Tuamotus and

Mangareva, and then 1,000 miles west to the Southern Cooks and 1,600 miles northeast back to Hawai'i. Some contact with West Polynesia seems to have occurred through the Northern and possibly the Southern Cooks. The overall area is possibly larger if occasional voyaging from New Zealand occurred. Trade, warfare and expulsion are generally mentioned as the main reasons for voyaging.

The traditions of the Northern Cooks, Tuamotus, Marquesas and Mangareva suggest that voyaging may have declined as initial populations increased and became more settled. This seems to parallel a corresponding increase in competition for land and warfare over limited resources. Certainly there is an increase in stories about the killing of any new arrivals some time after initial settlement. Some generations after settlement, subsequent voyages tended to be forced rather than voluntary.

CHAPTER TWELVE

AOTEAROA AND REKOHU

Aotearoa (New Zealand) and Rekohu (The Chatham Islands) are situated 1,600 miles southeast from Rarotonga and about 1,150 miles south of Tonga (See Fig.1, and Fig.37). Estimates of the pre-European Maori population vary from between 125,000 to 250,000 (Davidson 1984:58). The first European arrival was Tasman in 1642 followed by Cook in 1769. After 1840 European settlement accelerated. Missionaries began arriving in 1814 (Walker 1994:78-80).

Aotearoa

Despite the likely considerable loss of oral tradition the amount of extant material from New Zealand is still impressive. However, up until the middle of this century the Kupe (925AD), Toi (1500AD), fleet (1350AD) reconstruction promoted by Smith (1910), Tregear (1891), Best (1925) and others dominated the analysis of oral tradition. Fortunately much good work has been done to debunk that particular set of myths. Much of that work was completed by David Simmons (1976) in The Great New Zealand Myth, who examined a good number of early traditions in manuscript. The current writer is fortunate to be able to benefit from that work.

The main feature of the canoe traditions of Aotearoa is the large number of canoes mentioned. In several summaries 105 different canoes are named (White 1887:176-194; Tregear 1891:20-22; Gudgeon

1892:212-217; 1903:51-61, 120-130, 166-179; Best 1925b:390-421; Hiroa 1949:9-64; Winiata 1950:1; Simmons 1976:68, 105, 162, 207-216; Keene 1988:17; Harrison 1992). Typically each tradition includes mention of arrivals from Hawaiki, usually not specifically located, the names of the captains, navigators and some of the crew. Several mentions of return voyages are made. Debate continues as to whether Hawaiki lies in East Polynesia or Northland. A third position is that argued by Orbell (1985) whereby the canoe traditions are religious constructions and Hawaiki a spiritual homeland.

The Traditions of Kupe

Kupe is generally regarded as the first navigator to arrive in New Zealand. Genealogically he is dated from between 40GB-1900 to 20GB-1900 with the more recent genealogies being the more likely. His canoe is variously named as *Takitumu*, *Aotearoa*, *Mataorua*, *Matahorua*, *Matahourua*, *Matawhaorua*, *Tamarereti* and *Uruao*. He is usually said to be from Hawaiki, although there is one mention of his arrival from Wawauatea, which, linguistically is the equivalent of Vava'u an older name for Borabora in the Societies and the island of the same name in Tonga. One early Northern version refers to three Kupe, being; Kupe Nuku who came to New Zealand, Kupe Rangi and Kupe Manawa. Smith mentions two Kupe although only as an attempt to reconcile disparate genealogies (Simmons 1976:22, 42, 216).

One of the main points of issue concerning Kupe is whether or not he was the first person to New Zealand. Certainly one of the main characteristics of other Polynesian traditions is that those who are referred to as 'first arrivals' have almost invariably arrived some time after previous, earlier occupants. One story is that Kupe arrived with his two daughters Mohuia and Tokahaere and also two birds Rupe and Te Kawauatoru, that is, a pigeon and a cormorant. Later one died and the other deserted Kupe and settled with other birds in the South Island (Te Whetu 1893:147-

151). It is likely that the birds are metaphoric descriptions of humans. In another 1854 account recorded by Grey (1854:90-98) the text clearly states that Kupe saw two persons, a crow (Kokako) and a fantail (Tiwaiwaka). Later, when talking to Turi, Kupe informs him that he saw two people. In yet another version New Zealand is said to have already been occupied by Turehu of Mamoe, and the Patupaiarehe who were descendants of Maui (Graham 1919::111-116). As noted in other traditions and in Chapter Ten earlier settlers are often referred to as fairies, or spirits. There is also a tradition that a canoe named *Te Aratauwahiti* captained by Maku is said to have arrived before Kupe (Gudgeon 1892:217). Another explorer Poupaka is also credited as an old time navigator who lived two generations before Kupe (Best 1925:386). Another story claims the *Tereanini* captained by Pouheni was the first canoe here (Gudgeon 1892:217). One ancient song even recounts warfare between the settlers who accompanied Kupe and the Turehu (Ngata 1959:138-139). A Ngati Apa account is that Rakataura captain of a canoe named *Pauiriraira* was the first to arrive in New Zealand. Upon returning to Hawaiki he later sent Matakere and then Kupe to explore the land further (White 1887:188). An extensive list of place names certainly adds to the authenticity of Kupe's circumnavigation of the islands (Wilson 1990:17; Smith 1910c:39-43).

Other than being the first to Aotearoa, the Kupe traditions contain reference to migratory birds, cloud formations and star courses to New Zealand. One example is his description of the clouds over New Zealand, 'There are some peculiar clouds hanging there in the distance surely it is a point of land' (Smith 1914:208). Akerblom (1968:62) describes cloud formations, unique to New Zealand, where over mountains the apex of cloud builds up toward the northwest and toward the east the clear skies are clear. Smith (1921:216) also credits Kupe with determining the position of New Zealand after observing the flight of the long-tailed cuckoo arriving from the southwest and wintering in the islands of the Central Pacific.

The central issue from these traditions is the different astronomical directions for sailing to Aotearoa, said to have been left by Kupe in Hawaiki. These were outlined in Chapters Four, Seven and Eight, and were followed by the crews of the *Rehu Moana*, *Hokule'a* and *Hawaikinui*. One instructs:

Keep the sun, moon or Venus just to the right of the bow of the vessel and steer nearly southwest (Best 1922:29).

These instructions are ideal for voyaging toward Aotearoa during the month of November. At that time the sun and a mix of planets, stars and constellations including Mercury, Antares, the Tail of Scorpio, Sagittarius, Jupiter, Neptune, Uranus, Capricornus, Fomalhaut, Sculptor and Fornax, set in a continuous sequence at between 220 degrees and 250 degrees on the southwest horizon. The sun first sets at about eight in the evening, followed by the other stars and constellations, the last of which falls at about six o'clock the following morning. A second set of instructions is more problematic. It suggests that:

... the course be to the right hand of the setting sun, moon or Venus in the month of February (Smith 1921:216).

However, during February the sun begins to set at 250 degrees on the horizon. Steering to the right of the setting sun at this time of year could mean going past the North Cape and missing Aotearoa altogether. Although on the return voyage of *Te Aurere* in 1992 a course was steered directly into the sun and followed for some time before heading south (See Chapter Eight).

Of course one of the main concerns about these traditions is their authenticity. The suggestion that these directions were invented after contact with Europeans has to be considered seriously. None of the examples quoted appear among the authenticated manuscripts reviewed by Simmons (1976). Nonetheless, there are some other interesting factors. The sequence mentioned in the first set of guides is astronomically unique, such a continuous order of setting stars at the same point on the horizon being extremely rare. Given the other difficulties of weather and distance when sailing to Aotearoa,

they are also highly fortuitous, and make such a voyage significantly easier. It is also worth noting that the tail of Scorpio is also referred to as *Te Waka o Tamarereti* and *Te Uruao* (Best 1922:59). Both are names associated with Kupe, or very early first arrivals in Aotearoa. The tail of Scorpio sets in the southwestern horizon shortly after the sun in the month of November. The sources of the Maori names for this constellation seem independent of the known reconstructions.

The Traditions of Te Tai Tokerau

Northern traditions claim Kui, Tutumaiao and Turehu as early peoples. Tamatea is descended from Karetehe a chief of the Turehu. The Ngapuhi of Hokianga also claim they were taught how to use nets and fish by the Parau a tribe of the Turehu (Gudgeon 1903:176-177).

An early 1849 Ngapuhi account states that Nukutawhiti and Ruanui arrived from overseas on board the *Mamari*. They met Kupe at sea and were given instructions to proceed to Hokianga (Simmons 1976:208). In a version written between 1829 and 1835 Kupe is said to have crossed to Wawauatea where he reported that he had left two of his pets at a land to the south. Thirteen canoes were then built and, sailing in the company of Matawhaorua, went to New Zealand (Simmons 1976:212-214). In another 1855 account the six canoes, *Te Arawa*, *Takitumu*, *Kurahaupo*, *Naenaemoko*, *Horouta*, and *Tainui* are named as being built in the north, and having sailed from the north. Several ancestors such as Rakaiora, Ruatapu and Rongomai are said to be ancestors of Rahiri, the founding ancestor of Ngapuhi (Simmons 1976:216-218). That they also appear as ancestors in other tribal traditions argues for a New Zealand point of origin.

Other traditions concerning Tamatea of the *Takitumu* suggest that he was born in the north. Other tribal traditions claim arrivals from Hawaiki. However, Ngati Porou and Ngati Kahungunu are said

to have descended from these arrivals after migrations from the north. One version concerning Tumoana claims a return was made to Hawaiki (Simmons 1976:223-228). In one 1887 Ngati Whatua account the *Mahuhu* is built at Waerota and sailed to Matatera where the location of Aotearoa was learned. The canoe is reputed to have transported several plants, including the hue (gourd), kumara, ti (cabbage tree, and aute (paper mulberry), one of which is indigenous to New Zealand. The people of Kui were already living in the north as were Kauea and Tokorangi from Whakatane. Mention of Ngati Porou and Ngati Kahungunu being descended from the north is repeated (Simmons 1976:228-231).

The Traditions of Tainui

The Patupaiarehe and Ngati Kahupungapunga feature as early peoples in the traditions of Tainui (Gudgeon 1903:17; Cowan 1921:142-149). The earliest recorded account was in 1842. The Tainui, Te Arawa, Matatua and Kuraawhaupo are named as arrivals. The Tainui is variously named as arriving at the North Cape, Whangaparaoa, or on the East Cape. It is also said that the kumara, gourd, taro, and karaka (indigenous to New Zealand) were brought on board. Ngahue had gone back to Hawaiki with greenstone. As for the traditions from Te Tai Tokerau and Te Tai Rawhiti the reasons mentioned for leaving are warfare over gardens (Simmons 1976:165-181; 310). Characters associated with this canoe range from about 18GB-1900 to 23GB-1900 (Simmons 1976:286).

These traditions are consistent with Te Tai Tokerau. Earlier peoples are named already in residence. There is the transportation of food stuffs, frequently mentioned in all Polynesian tradition. In respect of another issue, it is worth noting that, in a soon to be published account written by Pei Te Hurinui Jones (Biggs 1994), there is an extraordinarily high correspondence of personal and place names associated with the Tainui voyage from Hawaiki with a very small area in the Bay of

Islands.

It should also be noted that although many reconstructionists included Rarotonga into some accounts, the name prefix 'Hotu' commonly occurs among voyaging traditions of Mangareva, Easter Island, the Societies and Tuamotus. Further examination is warranted.

The Traditions of Matatua

In the *Matatua* traditions the first people were descendants of Maui. Another early figure Tiwaiwaka or Tiwakawaka had a canoe named *Te Aratauwhaiti* and is dated about 38GB-1900. Another early visitor is Maku. Probably the earliest important ancestor is Toi who built the canoe *Te Aratawhao*, after the arrival of Hoaki and Taukata who brought the kumara. This canoe was sailed to Hawaiki to fetch kumara under Tamakihikurangi. There, a new canoe was built for the return, and named *Matatua*. Toroa was the captain for the return. Later, his brother Puhikaiariki took the canoe north. Toroa and Tamakihikurangi appear 16GB-1900. The *Aratawhao* story is similar to one for the *Horouta* from Te Tai Rawhiti. In one account the *Matatua* is stated as a companion canoe of the *Takitumu*. Given the strong connections of Tamatea and the *Takitumu* with the north a New Zealand origin is suggested (Simmons 1976:148-157, 271, 309).

Generally speaking the *Matatua* traditions are about re-entry into an already occupied area. Given the short genealogical depth, a strong association with the north, and with the *Takitumu* a New Zealand origin is possible. However, the association of Toi with East Polynesia is also possible because of the ancestor of the same name for that island. Interestingly there is an absence of mention about Toi in the traditions of Rarotonga. It should also be noted that there is a similar paucity in the East Polynesian traditions about the final end of Whiro, and more generally about Turi. Both are other East Polynesian navigators also associated

with New Zealand.

The Maku and Tiwaiwaka stories are consistent in nature with Polynesian traditions concerning earlier arrivals about whom little has been retained.

The Traditions of Te Arawa

Early versions concerning the Te Arawa mention Houmaitawhiti, Hei, Tia, Te Matekapua (Tamatekapua) and Ngatoroirangi as being on board. These characters appear in genealogies 18GB-1900 to 20GB-1900. Pikopikoiwhiti is mentioned as the lagoon the canoe is launched on. This is also mentioned in the traditions of Tainui as the place of launching. Interestingly, this is one name for the harbour at Mangonui and for an inlet in the Bay of Islands. An account by Te Rangikaheke (1849) names Kaia, Parima, Panono, Waerota, Rarotonga and Waeroti, as villages in Hawaiki. It should be noted that the name Rarotonga does not appear in the earliest recorded versions, and has been likely added after European contact (Simmons 1976:156-168, 281).

The story of this canoe mentions a dispute between Tamatekapua and his relations Toi and Uenuku over the killing of a dog for food. Both names appear commonly in Maori genealogies, although in Te Arawa they are named as living in Hawaiki. Generally speaking Te Arawa genealogies are significantly shorter than those from Tainui which contradicts the idea that they arrived together as part of a fleet.

The Traditions of Taranaki

An early 1847 account concerns Manaia and the Tokomaru. Rakeiora is also associated with this canoe. Again the place of departure is named as Pikopikoiwhiti. The land is also already occupied and the original inhabitants killed. Rakeiora is said to be priest

or captain on Tokomaru although Te Ati Awa mention Uenukutamaroa. Both figures are somewhat obscure (Simmons 1976:182-188). Both appear in northern genealogies.

Another canoe is the *Kurahaupo*. Ruatea and Moungaroa are associated with this canoe. Stories relate the planting of kumara and naming of places from Taranaki to the Wairarapa by Hau. The Aotea is another Taranaki canoe with Turi named as captain. He leaves Rangiatea after a dispute over the killing of two boys. The story includes Kupe giving Turi directions toward the setting sun and Aotearoa. The Aotea is credited with bringing kumara, rats, and the indigenous karaka and pukeko. Mention of Manaia, Rakeiora, and Moungaroa is scant in the genealogies. Moungaroa is sometimes associated with the *Matatua* and a figure named Manaia appears in northern genealogies. Rakeiora also appears in northern genealogies, and, is also associated with Toi and the early Ngati Awa lines. Rakeiora appears about 16GB-1900 to 20GB-1900, Ruatea 19GB-1900, Te Moungaroa 16GB-1900, Turi appears 16GB-1900 to 23GB-1900 (Simmons 1976:188-200; 296). The genealogical connections suggest a New Zealand origin.

The Traditions of Te Tai Rawhiti

Latter day Ngati Kahungunu reconstructions as published by Smith (1913, 1915) in The Lore of the Whare Wananga have been largely disproven and are rejected here. Another story about Maui having left his canoe on Hikurangi is also of post-European invention (Robertson 1969:253). The main canoes associated from Te Tai Rawhiti are *Nukutere*, *Takitumu* and *Horouta*. The captains and important people are named as Whironui, Paoa, Paikea, Tamatea and Kahungunu.

As with other canoes the *Horouta* and *Takitumu* were associated with *Pikopikoiwhiti*. A 1865 to 1866 account outlines the story of the *Horouta* being sent by Toi to fetch kumara. The venture is organised by Kahukura and captained by Pawa. Toi is also

associated with this voyage (Simmons 1976:140).

One tradition is that directions were given to the Takitumu to sail to Aotearoa as follows:

..the stars relied on during the voyage hither of Takitumu were Autahi (Canopus), Tautoru (Orion's Belt), Puanga (Rigel), Karewa, Takurua (Sirius), Tawera (Venus as morning star), Meremere (Venus as evening star), Matariki (Pleiades). Tamarereti (Tail of Scorpio?), Te Ikaroa (the Galaxy)(Best 1922:35).

Possibly the only useful ones on a November course to New Zealand are Meremere and Tamarereti. A second set instructs as follows:

Carefully keep the prow of the vessel laid on Venus during the night, during the daytime follow behind Tama-nui-te-ra (the sun)(Best 1922:35-36).

These instructions were said to have been given by Kupe. In this version he is said to have been on the Takitumu. In the late afternoon it is possible to steer toward the sun as it declines on the horizon.

Important figures associated with the Takitumu, Kahungunu and Tamatea, date on average to about 14GB-1900. Both seem closely related to the traditions and genealogies of Te Tai Tokerau. A New Zealand origin is further supported by the story that many important figures in the traditions travelled overland which would necessarily require a certain amount of foreward geographic knowledge (Simmons 1976:317). Interestingly one early manuscript states that the Takitumu and the Horouta were one and the same. Whironui and Paikea are associated with the traditions of the Southern Cooks and Society Islands concerning Whiro and Ruatapu. Whironui is placed about 16GB-1900 to 22GB-1900. Although he is obscure in the genealogies this would be consistent if overrun by later arrivals from north. Paikea is dated from 15GB-1900 to 24GB-1900, and Paoa about 24GB-1900 (Simmons 1976:125-132, 263, 308-309).

In further support of a Rarotongan connection Uengapuaariki or Uengapuanaki is said to have arrived on Horouta (White 1887:183). Uenga also appears as one of the names of Tangi'ia the famous

ancestor of Rarotonga. The name Tangi'ia also appears in some East Coast genealogies. Other chiefs mentioned in this tradition are Huatahi and Nukuroa. Nukuroa was formerly the name for Mauke and Mitiaro in the Southern Cook islands.

The Traditions of Te Waipounamu

Early inhabitants before Ngati Mamoe, Waitaha and Ngai Tahu are Te Raoupomanu, Kahuiroko, Te Rapuwai, and Kahuitipua (Beattie 1915:108). The traditions from the South Island imply that settlement was from the North Island. An early 1844 account, states that the lower South Island was formerly occupied by Ngati Mamoe about 19GB-1900. North of them at Wairau were the Te Huataki who had crossed from the North Island. In the west were Ngai Tara who had also moved south under Te Puhirere who was of the same descent as Ngapuhi. In another 1844 account a group of canoes were blown away from the Taranaki coast. Some were lost at sea. Survivors landed on the northern part of the South Island. Other informants on the east coast of the South Island gave similar stories of being castaway from both the east and west coasts of the North Island (Simmons 1976:203-204).

An earlier canoe named *Araiteuru* is mentioned. It is said to have brought kumara, taro and the gourd. The canoe is reported to have got into trouble and ditched the cargo at sea. Later the canoe capsized. There were only two survivors. Hipo is named as captain or navigator. Another account names Puketapu as a chief and one of two survivors although in the second account Hipo, Puketapu and Te Kaihinaki are named. It is generally agreed that the canoe was wrecked near Moeraki (Simmons 1976:204-27). In a 1915 account one Orokoiteata arrived from Hawaiki and made two canoes, the *Manuka* and *Araiteuru*, which later returned to Hawaiki to fetch the kumara. Pikihiwitahi and Te Hiwi were the captains. The cargo of the *Manuka* rotted and the *Araiteuru* as mentioned was wrecked (Beattie 1915:108).

Other canoes are mentioned such as *Huruhurumanu*, *Takitumu*, *Aotea* and *Kurahaupo*. Most continue the theme of a North Island origin (Simmons 1976:207). Waitaha also have a tradition of being descended from the *Uruao* (Best 1901:119). The *Uruao* is associated with Kupe.

Drift and Return Voyages

The traditions of Aotearoa include mention of several return voyages to Hawaiki. The *Matatua* traditions mention the canoe *Te Ara Tawhao* returning to fetch the kumara. On the East Coast a similar story surrounds the *Horouta* (Simmons 1976:68-69). In the Taranaki traditions of the *Tokomaru* one of Nuku's canoes the *Waimate* is said to have returned to Hawaiki after the pursuit of Manaia (Best 1925b:415). In another Taranaki account, the *Pangatoru* commanded by Rakewananga or Rakeiwanangaora was not allowed to land and returned to Hawaiki (White 1887:183). In another story the canoe *Wakirere* is said to have left Hawaiki and fetched kumara from Matatera and then to have returned to Hawaiki without coming here. Two others are said to have arrived in Taranaki and then made returns to their own land (Tregear 1891:22). One East Coast account is that Hinerakai arrived from 'Polynesia' in search of her brother Tu Te Amokura who had been blown away on a drift voyage (Best 1925b:395). Another canoe the *Haere* stopped here shortly then returned with all of her crew to Hawaiki (Gudgeon 1903:129). The *Takitumu* is also said to have gone back to Rarotonga under Takahi and Rongokako (Best 1925b:414). Tamahua who came on *Kurahaupo* is said to have made a return on *Te Ronawaiwai*. Pourangahua also went back. Two East Coast stories are that Tuwhirirau and later Mou Te Rangi left for Polynesia. Another more recent venture was made from the East Coast by Pahiko. Another even more recent story that a canoe left Tauranga in 1830 to search for Hawaiki is uncorroborated (Best 1925b:416-418). In the northern traditions Mangawhai, Wakatuwhenua, Te Aukanapanapa, and Whangateau, all near Te Kawau Whangarei were said to be departure points for Hawaiki (Best

1925b:397-398).

Drift voyages are recorded in New Zealand traditions including one where a fishing canoe from the Bay of Islands was driven to a small island. The castaways built four outriggers and later returned. Another fishing expedition from Hauraki was at sea for eighteen days before striking land. Led by Marara they made a return navigating by the stars and landed in the Bay of Islands (Best 1925b:418-420).

Rekohu

Rekohu lies 500 miles east of New Zealand (See Fig.1). In the first tradition about arrivals the canoe *Tane* was captained by Kahu who found the island already occupied by descendants of cosmological personifications Te Aomarama and Rongomaiwhenua. One of those descendants was Kahuti who was said to be living at Kaingaroa. Kahu was said to have come from Aotea and Hawaiki. Corresponding place names indicate arrival from New Zealand. Later two other canoes, the *Rangimata* and *Rangihoua* reached the Chathams after a war between Tumoana and Rauru. The captains of those canoes were Te Rakiroa and Mihiti. A return by someone from the previous Kahu migration is implied because in the manner of Kupe some of the crew were instructed as to the whereabouts of the Chathams. Several years later the *Oropuke* under Moe of the Rauru tribe arrived (Tregear 1891:253-254; Shand 1895:36-40; 1896:13-32; Hiroa 1949:13-18).

The traditions of Rekohu are consistent with those elsewhere in Polynesia in that they mention earlier occupants about whom little knowledge has been retained. They differ in that after these early founding arrivals there are no other traditions of contact with the mainland.

Summary

Continuing debate surrounds the traditions of Aotearoa. That debate is reconsidered here in some detail because the outcome will say much about the voyaging capabilities of pre-European Polynesians. Smith (1910) promoted the idea of the 'fleet' arriving from East Polynesia in 1350AD on the basis of several dubiously conjoined traditions. This theory was seriously challenged by Simmons (1976) who suggested that Hawaiki was actually in Northland. Orbell (1985) went further and suggested that the canoe traditions were mythical-religious constructs designed to imbue their adherents with prestige. She also likened Hawaiki to a fabled paradise. Orbell's dismissal of the canoe traditions in general does not ring true when Polynesian traditions are considered as a whole. Her challenge that Hawaiki represents a spiritual homeland perhaps has some merit. Certainly there is a case that many of the traditions referring to Hawaiki as a homeland, may be alluding to Northland.

The pattern of little known mythical first peoples followed by more genealogical verifiable immigrants occurs throughout Polynesia. Obviously there is a difficult area between the mythological and historical, and indeed mythological elements occur even in recent tradition, but Orbell's discounting of tradition as a whole is as pre-emptive as Bigg's and Walker's discounting of historical elements occurring in myth.³⁴ Myth and tradition are intertwined, the task is to unravel the two not dismiss one or the other.

The several traditions of canoes arriving from a foreign Hawaiki is debatable. The cause of the migration in Ngati Whatua tradition of fighting between Rongomai and Rongoatu over kumara gardens is the same as the Ngati Hei tradition of Rongo and Tu. Both are also similar to Whakatane and East Coast traditions of

³⁴ See Chapter Nine.

brothers fighting over food crops. Information from the north also links migrations of the descendants of Toi and Ngati Awa to Taranaki and the Bay of Plenty. Links with the East Coast are also mentioned in the genealogy for Kahungunu and Tamatea. At least one very early account states that the main canoes were built in Northland. Pikopikoiwhiti, the name of two well sheltered harbours in Northland, is mentioned several times in traditions from all over the country as the point of departure.

There is also a strong connective similarity in traditions held by Ngati Whatua, Waiohua, Ngati Hei of Hauraki, Whakatane, Ngati Porou, Ngati Kahungunu and Rangitane. Links with a northern Rahiri and Puhi are acknowledged in the traditions of Ngati Awa movement from the north by Ngati Rahiri of Puketapu, Ngati Ruaanui and Ati Awa of Taranaki, Ngati Hau of Whanganui, Ngati Kahungunu and Ngati Porou and Ngati Awa of Bay of Plenty (Simmons 1976:320). The *Te Arawa*, *Tainui*, *Aotea* and other traditions about canoes conveying items indigenous to New Zealand also suggests a New Zealand origin. That many of the canoes are said to have been constructed from totara also supports this. In 1893 Grey commented that the Maori themselves were divided on the issue, some saying that Kupe was from overseas while others stated that most of the stories referred to coastal migrations occurring after populations already established (Simmons 1976:321). In support of the second view it should be noted that reliable consecutive canoe genealogies do not date back at the most past 1200AD and that archaeologically settlement may have preceded that date by 300 or more years. Orbell also noted that in Tuamotuan the word 'kupe' meant to circumnavigate land (1985:29).

The archaeological evidence depicts a scenario where early arrivals congregated in the south and on the coasts. The record also shows that the early settlers were frequent and capable coastal mariners and traders. Later after certain climatic changes and a depletion in animal stocks, such as the seal and moa, those populations moved north and began competing fiercely

over arable land. This in turn led to several migrations south by displaced peoples. The archaeological time frame of these migrations corresponds quite well with the canoe traditions.

In respect of this issue there is one aspect where the traditions of New Zealand are not consistent with those elsewhere in Polynesia. In the first instance of the traditions throughout Polynesia there is mention of frequent voyaging within the island group or initial close quarter contact with other island neighbours. If indeed the major traditions of New Zealand do refer to contact with a Polynesian Hawaiki then the traditions would be totally unique in Polynesia because they would contain no reference to voyaging within the first zone of probable contact, that is along the coastline of New Zealand. The main body of the traditions of all other Polynesian groups concern contact with their closest island neighbours, usually within the island group. The harbours and coastal districts of Aotearoa are the direct equivalent of that kind of close quarter voyaging. In addition to this the New Zealand traditions would contain almost no mention of trading along its coastlines which again is inconsistent with the traditions throughout Polynesia. It would also be a major contradiction if the traditions spoke only of contact with islands nearly 2,000 miles away without any mention of localised voyaging. This would also deny the many genealogical links which bespeak an earlier period of coastal contact.

In addition to this the archaeological record shows quite clearly that coastal trade in stone items was common. Significantly there is a strong association of adze types found in Northland, the Bay of Plenty and the East Coast, all of which have strong genealogical connections. The nationwide distribution of stone is also supported (Davidson 1984:20, 33, 198).

On the other hand there is also a strong correspondence between the East Coast traditions of Whironui, the Taranaki traditions of Turi, and those of the Society and Southern Cook Islands. Other East Coast genealogies mentioning Ruatapu and Paikea

reinforce this link. Interestingly, Whironui and Turi are navigators said to have left Tahiti. Kelly (1955:181-196) summarised the possible connections with the Southern Cooks. He noted that Nukuroa was formerly a name for Mauke and Mitiaro. The East Polynesian genealogies for Tangi'ia and Whiro match Northern, East Coast, and Bay of Plenty genealogies dating from 1849. These three areas also share much in common between them. At best one could surmise that all three were commonly connected with that area rather than as a series of migrations. That is all three are descended from ancestors who formerly came from that area of Polynesia. Certainly, the statistical occurrence in the number of place names found on Rarotonga that are also found in Northland, the Bay of Plenty and East Coast is very high. The unique directions said to have been left by Kupe, and their coincidence with the ideal time of year for such a voyage further supports some contact.

While reviewing the traditions the writer also noted a similar correspondence occurs between some of the personal and place names that occur from Taranaki and those from West Polynesia and the Polynesian Outliers. This correspondence seems to coincide with the traditions surrounding the *Kurahaupo* and *Tokomaru* canoes both of which remain genealogically obscure. Tradition of this nature is generally characteristic of very early contact.

If it were proved that the main canoe traditions did refer to coastal migrations then that need not denigrate what we might think about Polynesian voyaging capability. A possible scenario is that very early arrivals came here probably by deliberate voyage. This is likely simply because it is far too difficult and cold to do otherwise. Unfortunately little if anything is known about those peoples except in the traditions about the Turehu, Patupaiarehe and others. The early arrivals were coastal and as with other Polynesian peoples voyaged extensively within their own region of contact, that is along the coasts of New Zealand. Around 1400AD to 1500AD when seal and moa populations began to drop, and temperatures became lower, there was some movement

north. The population was then largely concentrated in the north. The emphasis in food production shifted from hunting and gathering to agriculture based primarily on the cultivation of the kumara. Those who managed to master the growing of the kumara became more powerful because of their food production base produced a surplus and supported a larger population. Later some groups began returning south via coastal trade networks. Around this time one or two canoes may have arrived from West Polynesia. Alternatively, such a canoe may have arrived even earlier. Then during the time of the return migration southward there were more arrivals from East Polynesia. Some returns into the Pacific may have been made but those referred to in the traditions were probably coastal voyages returning north to retrieve kumara.

Another point is that New Zealand is the largest of the Pacific Islands of Polynesia. There would not be much incentive to make long, hazardous return voyages from there into Polynesia. Perhaps the alteration in canoe design, reduction in the use of sails and loss of navigational skills suggest an early end to long distance blue water voyaging.

The most important point would be that deliberate voyaging to and or from East and West Polynesia probably occurred more than any sceptics would admit, and less often than the advocates of deliberate voyaging would like to accept.

PART FOUR

NAVIGATION SYSTEMS AND WAKA DESIGN

The General M/S Design

CHAPTER THIRTEEN

THE POLYNESIAN NAVIGATION SYSTEM

The new age of 'hands on research' and experimental voyaging, as reviewed in Part Two, created an increasing belief that Polynesians, and their Micronesian cousins, were admirably capable navigators. This view is supported by the summary of Polynesian oral tradition in Part Three. In conjunction with the archaeological discussion, and literature review in Part One it is possible to affirm that a new consensus has emerged about the evolution of the Polynesian voyaging and the principles of its navigation system. This chapter presents a comprehensive outline of both.

The Evolution of Voyaging

Polynesian voyaging has its beginnings around 50,000 years ago with the first movement of humans beyond the Sunda shelf. Two phases of voyaging and colonisation occurred, the first began about 50,000 years ago and the second after about 3,500 years ago when the Lapita people moved into West Polynesia.

Pacific sea levels reached their present position some 5,000 to 6,000 years ago. Over the previous 50,000 years they were generally lower and fluctuating, and this in turn affected the course of settlement in the Pacific. During the first phase of voyaging the sea between Sunda and Sahul, it was possible to

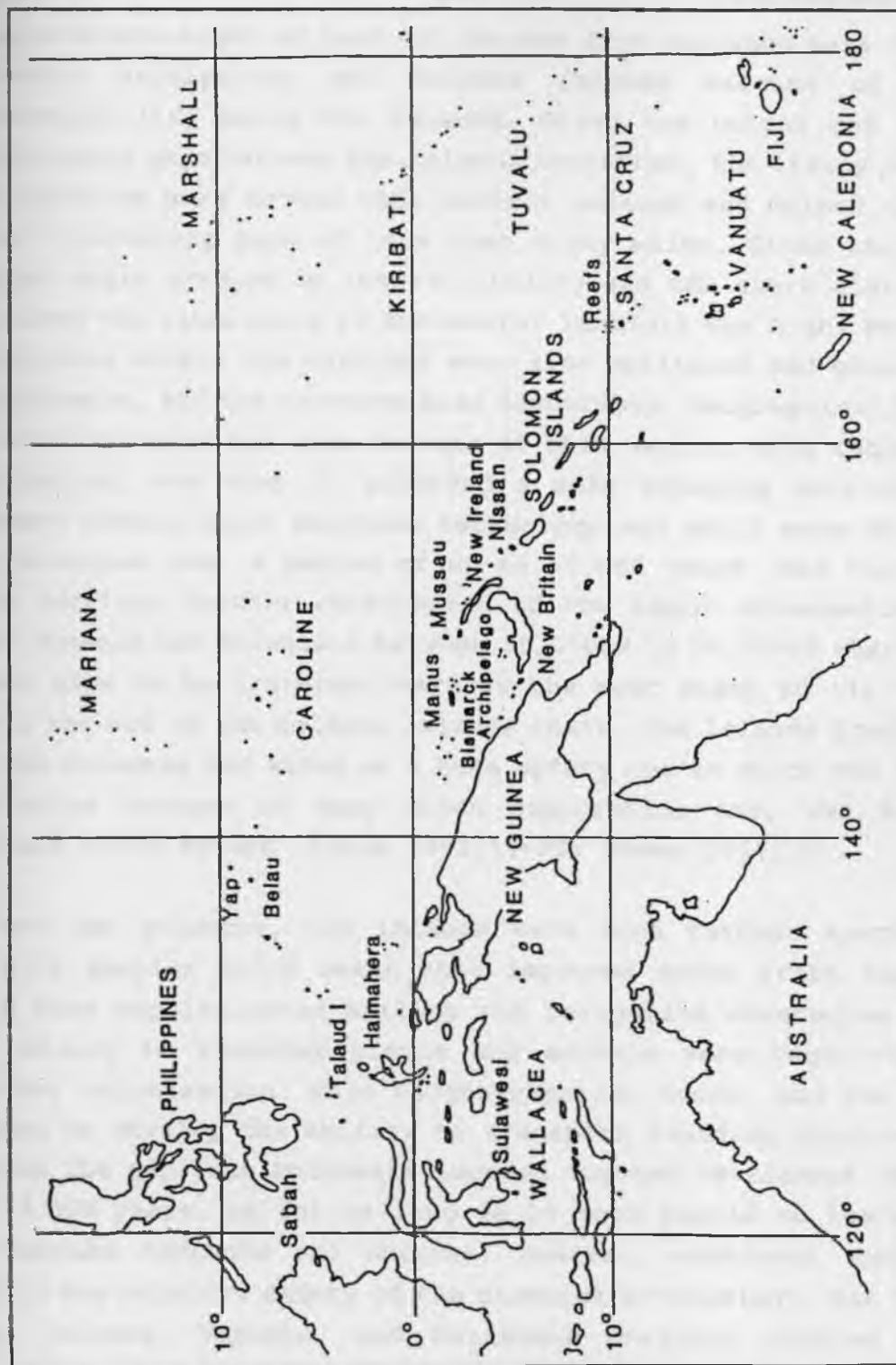


Figure 1: The Voyaging Nursery (Irwin 1992:32).

remain within sight of land all the way from mainland Asia to the Bismarck Archipelago and Solomon Islands because of good intervisibility among the islands. Given the height and short intervening gaps between the islands concerned, the likely routes of migration were dotted with several islands and island chains with intervening gaps of less than sixty miles. Given the wide target angle created by intervisibility and the short distances involved the likelihood of successful landfall was high. Weather conditions within the corridor were also sheltered and generally predictable, and the currents also favourable. Geographically and meteorologically the main feature of this region, with regard to navigation, was that it afforded a safe voyaging corridor or nursery within which maritime technology and skill were able to be developed over a period of up to 50,000 years (See Fig.39). This corridor further contributed to the rapid colonisation of Near Oceania and Melanesia between 30,000BP to 50,000BP where the water gaps to be traversed were at the most sixty to 110 miles until the end of the Solomon Islands chain. The islands from Asia to the Solomons had acted as a huge safety net to which the first tentative voyages of deep ocean exploration into the Remote Oceania could return (Irwin 1992:19-25; Green 1994:25).

Beyond the Solomons, the islands were much further apart and usually smaller which meant that improved water craft coupled with more sophisticated sailing and navigation strategies, and an ability to transfer plants and animals were required for further colonisation. This biogeographical break, and the time needed to develop the ability to transport founding populations across the gap into Polynesia impeded further settlement for up to 25,000 years, or for as long as it took people to learn how to venture offshore and survive. However, continual voyaging within the relative safety of the Bismarck Archipelago, the Santa Cruz Islands, Vanuatu, and Melanesia corridor offered safe sailing conditions for such skills to be learned and a place to which the first, experimental voyages could return safely (Irwin 1992:5-6, 31; Green 1994:25).

Movement through the corridor favoured the early operation of simple craft. Bark boats and wood or bamboo rafts were the earliest form of water transport. Bark boats, although of greater antiquity, are generally only associated with some parts of Sunda and the Australian Coast. Therefore, the main precursor favoured as the forerunner for the further development of ocean going vessels is the wood or bamboo raft, which is found on Mainland Asia, Indonesia and further into the Pacific. Technologically they were simple to build, very seaworthy, and capable of good speed downwind. Other types such as mangrove rafts, logs, bundles of reed and dugouts may also have been used (Lewis 1977:4-7; Irwin 1992:25-26, 42-43; Green 1994:22).

Other developments in maritime technology occurred. Firstly, this involved the development of sails to increase the downwind speed of rafts or dugouts, and secondly a progression in the skill of sailing across the wind. Advances in the ability to sail across the wind also necessitated further technical progress in terms of preventing the boat from either being pushed sideways or being blown over on its side. A solution to the first problem came with the emergence of the dugout which sat lower in the water and later the steering oar, both of which provided lateral resistance. The problem of capsizing was solved with the adoption of the use of outriggers or two dugouts used in tandem. A further innovation was the ability to change direction in relation to the wind. Larger boats started being built which meant that the size of crews, cargo and provisions could be increased. This also improved the margin of safety. As boats gradually developed so did coastline navigation which ultimately led to the appreciation of how to sail further offshore and return safely (Irwin 1992:43).

Once the technology and skill level had been adapted the next step was to develop an appropriate strategy for deep sea exploration. Writers such as Sharp (1956) and Finney (1979) have estimated a high rate of mortality during the settlement of the Pacific. However, the traditions as reviewed in Part Three

mention only rare losses at sea. Certainly sailing between known and unknown islands has its risks, but sailing into empty ocean is fatal. The strategy that was adopted was that it is safest to sail first in the direction that is normally upwind because one can then expect a fast trip back if problems are encountered or landfall unsuccessful. The hard way is really the easy or safe way. This simple paradox is one of the keys to explaining the pattern of settlement voyaging in Polynesia. Nearly every radiocarbon date in the remote Pacific supports the view that colonisation went first against the prevailing winds, then across and down them. The skill and strategy employed probably developed to a sufficient level from within the Lapita complex as a result of their extensive trade networks, which over several thousand years, were sufficient to hone navigational skills to a high level. Put simply, east-bound voyages could leave islands with westerly winds brought on by seasonal variations. Once the predominant trades returned they could then return or reach across them north or south waiting for further favourable changes. Once food and water began running out, or the crew were exhausted, the search could end and the canoe could turn about and make a fast return before the trades (Irwin 1992:7-8, 42-43, 56-57; Green 1994 :22).

Determining the Direction of Land

Thousands of years of exploration, trade and voyaging were involved in the establishment of the Polynesian system of navigation. There are three main tasks in navigation. The first is the ability to set a course from land. The second is to navigate at sea which involves, maintaining direction, judging position and estimating distance covered. The third is to make safe landfall (Irwin 1992:45).

David Lewis assembled much information about the 'signposts of nature' and reaffirmed Denning's (1962) observation about the usefulness of the flight paths of migratory birds as directional

determinants for land (Lewis 1964:364, 1972:172-173). Once the direction of land was established then natural markers such as trees or mountains were well nigh universally used as back-sights to fix the course (See Fig.40). For example, when making for Anuta, Tikopian navigators align their canoes with landmarks on a beach named 'Mataki Anuta' (looking on Anuta)(Lewis 1972:106-107; Irwin 1992:45). This also meant that departure was usually during the hours of daylight, and as Parsonson noted this was customarily 'done in the early evening when it was dark enough to see the brighter stars but still sufficiently light to discern the landmarks against the sky'. Alternatively, and for similar reasons, departure could occur in the early hours of the morning. (Parsonson 1962:43; Lewis 1964:365, 1972:61). Navigational markers such as rocks in the Gilbert Islands, Tonga, and the Cook Islands were also erected as permanent records of course headings, and for the purpose of instruction (Hilder 1962:84-88; Lewis 1964:365, 1972:316-322).

Navigation at Sea

While maintaining course at sea Polynesian navigators used sophisticated star compasses to track star paths to target islands (See Fig.41). The star paths functioned according to fundamental principles of astronomy, the most simple use of which entailed the observation of horizon and zenith stars.

Horizon Stars

Horizon stars rise in the east and set in the west at the same point on the horizon year round. Their only variation occurs in the time at which they rise and set; being four minutes later each day so that a star rising at nine in the evening will rise in the same position at nine in the morning six months hence. Courses were set by following an observable sequence of stars rising in line with the bearing of the desired destination. A

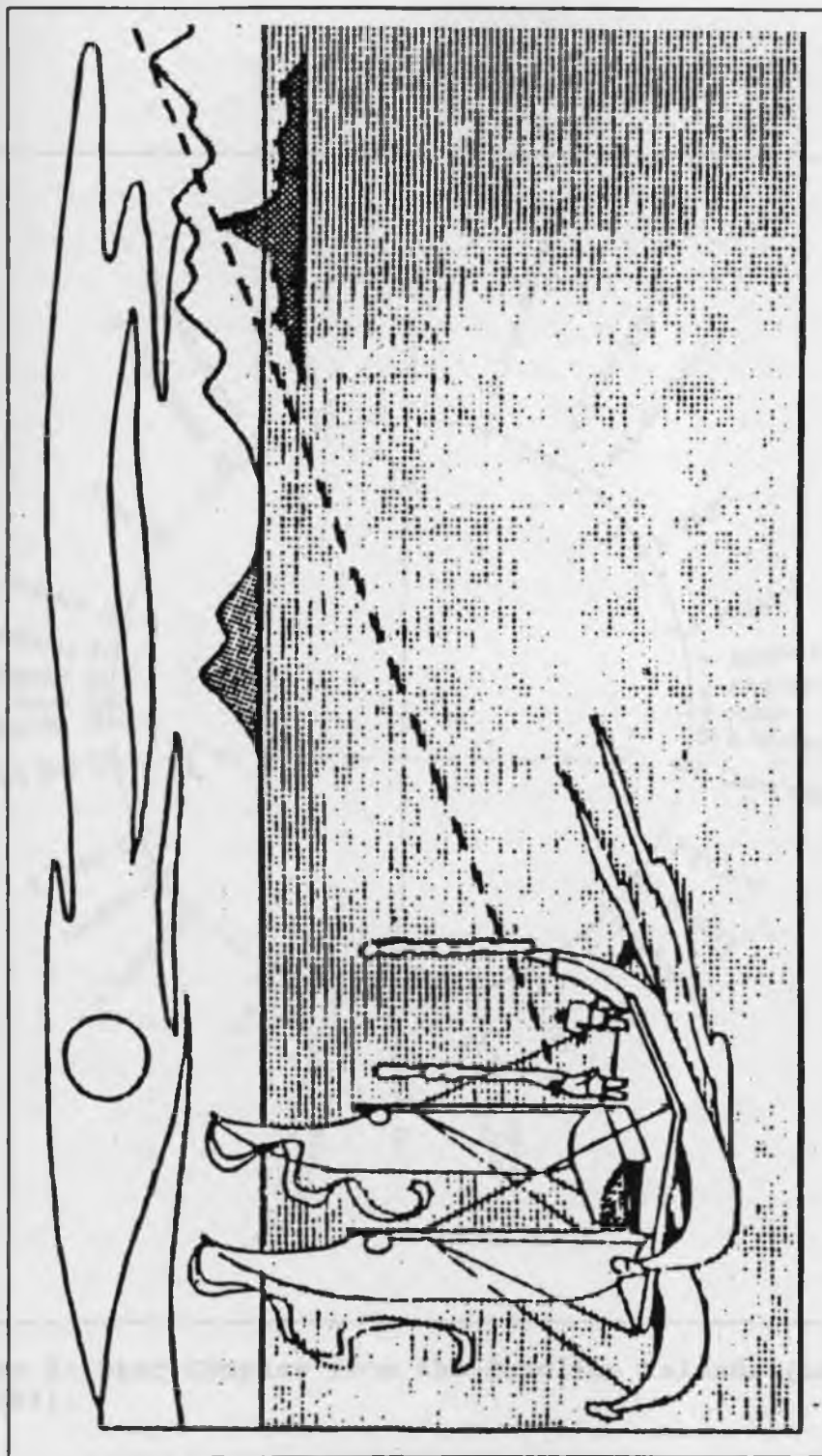


Figure 40: Back Sighting Canoe in line with Two Mountains (Kane et al 1984:103).

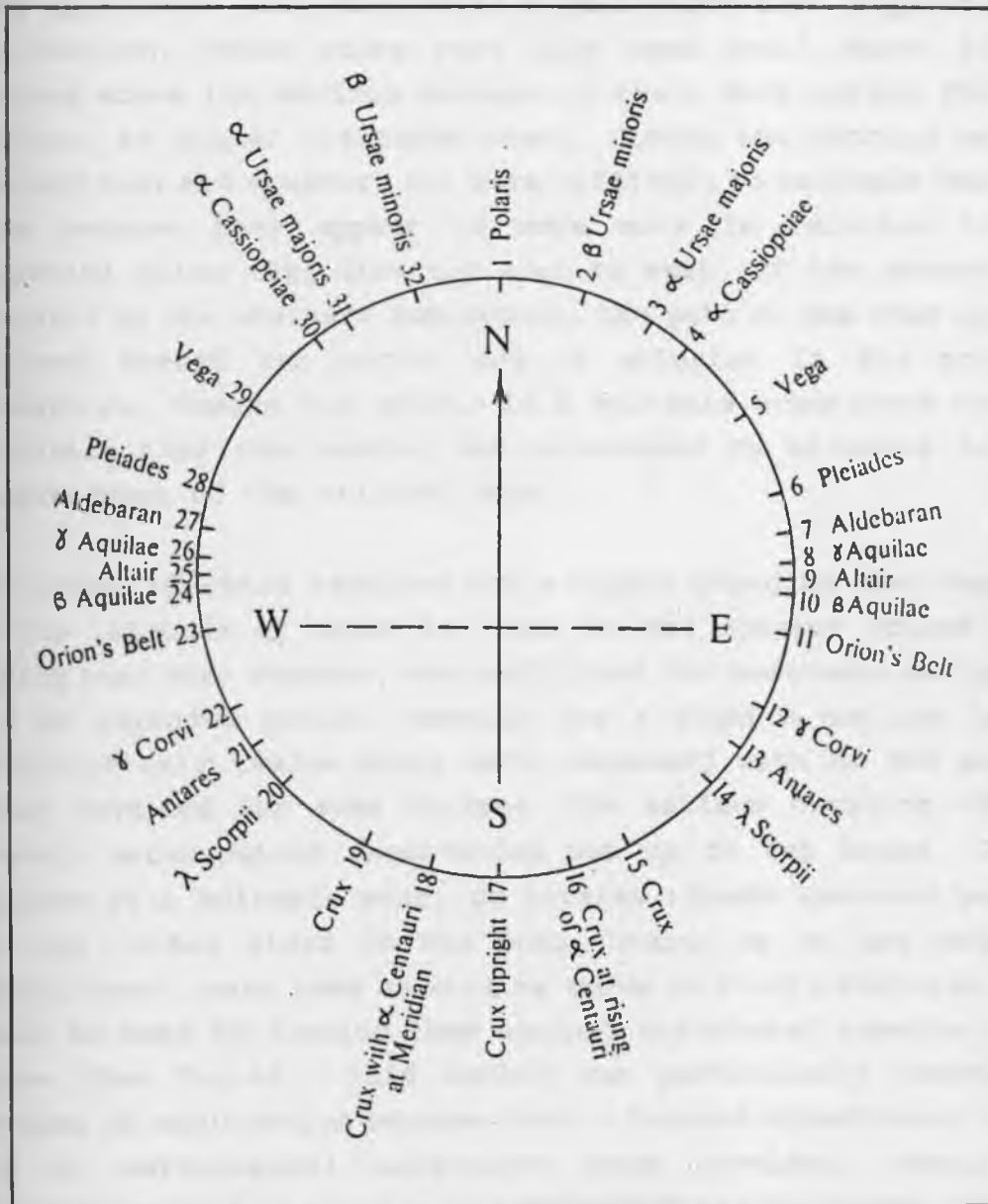


Figure 3: Star Compass from the Caroline Islands (Lewis 1972:62).

star was first utilised when already slightly above the horizon to avoid problems of cloud and haze. As it rose and moved off across the sky, another star rising in the same position was selected. Generally speaking equatorial stars and constellations were able to be used when still a full forty-five degrees above the horizon. Other stars were only used until about fifteen degrees above the horizon because of their declination from the equator. At higher latitudes stars, rising and setting between the meridian and equator, are more difficult to maintain bearings from because they appear to move more in relation to the celestial poles than directly east to west. If the observer is situated in the southern hemisphere, the path of the star appears to bend toward the north, and if situated in the northern hemisphere, toward the south. If a suitable substitute was not available then the heading was maintained by allowing for the displacement of the original star

The number of stars required for a nights voyaging also depended on the latitude at which it rose. On the equator Orions Belt, rising near zero degrees, was sufficient for east-west navigation for an extended period. Usually for a night's sailing in one direction only twelve stars were necessary with as few as five being required for some courses. The maximum duration of each nightly astronomical observation was up to ten hours. In the absence of a suitable star, or because clouds obscured part of the sky, other stars on the beam, stern, or at any angle to actual track, were used as well as those in front. Multiple stars could be used by framing them against structural aspects of the canoe (See Fig.42). This method was particularly useful for voyages of exploration because both a forward directional sight, and an astronomical back-sight were provided, should the navigator wish to return to the island of origin (Lewis 1972:45-57; Irwin 1992:45).³⁵

³⁵ Star paths were called 'Te Ara Whetu'; 'Kavenga' in the Polynesian Outliers; and 'Kaveinga' in Tonga (Lewis 1966:88, 1972:57-58).

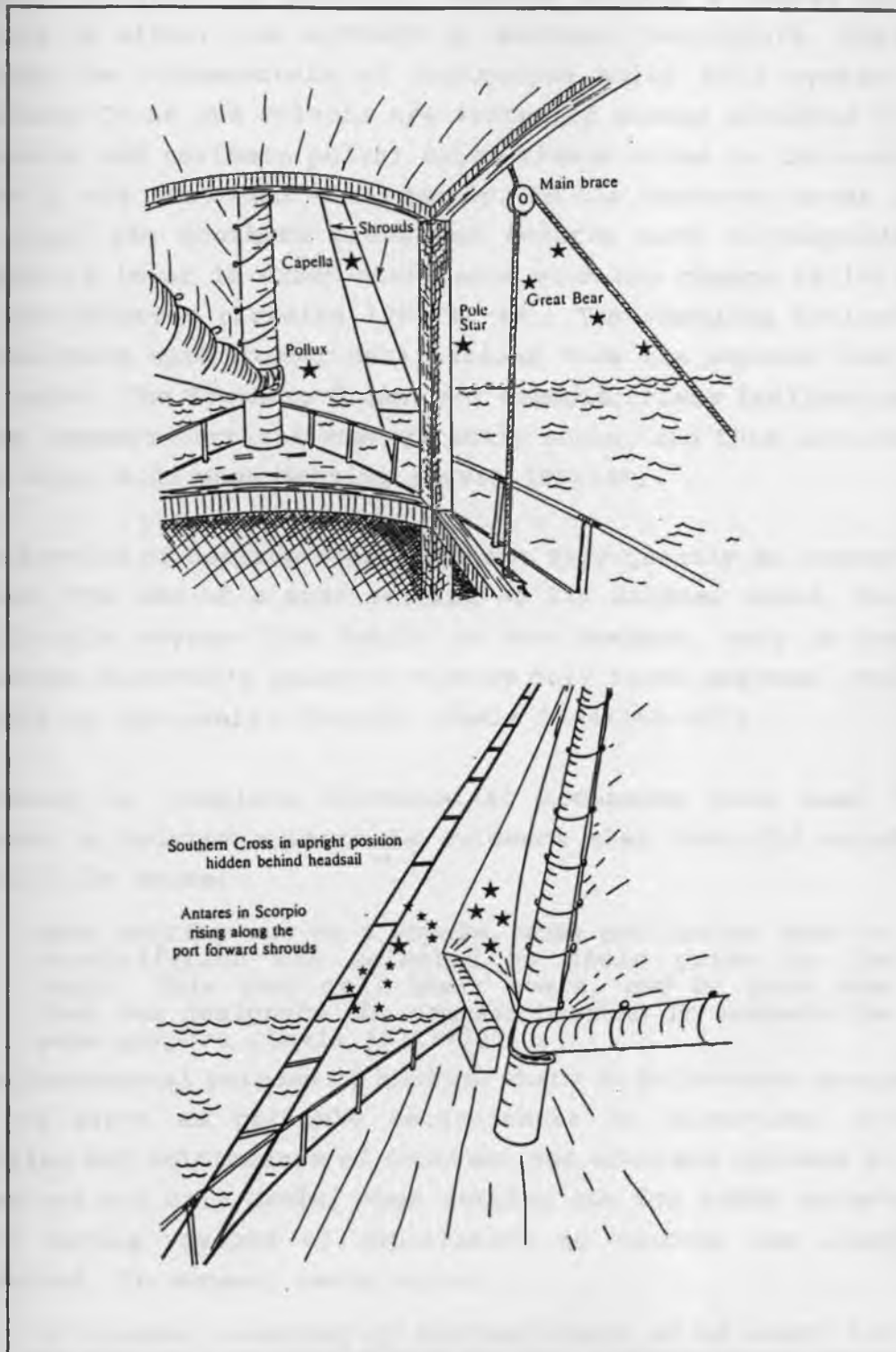


Figure 4: Maintaining Course by Aligning Sails, Rigging and Shrouds with Stars and Constellations (Lewis 1972:51).

Static variation in position, whether setting a course from an island in either the northern or southern hemisphere, does not change the fundamentals of navigation using this system. The Southern Cross and Polaris are virtually always situated at the southern and northern poles; Orion always rises in the east and sets in the west near the equator. As the observer moves north or south the Southern Cross and Polaris move correspondingly higher or lower in exact accordance with the change in latitude of the observer (Kyselka 1987:42-44). The changing attitude of these stars with higher declinations from the equator can also be useful. The Southern Cross, for example, rises inclined on one side, appears vertical when directly south, and then inclines on its other side when setting (Irwin 1992:45).

The bearing of horizon stars does not vary greatly as canoes move about. The use of a star setting at 225 degrees would, for the 2,000 mile voyage from Tahiti to New Zealand, vary in bearing from the observer's point of view by only three degrees, over the length of the entire journey (Lewis 1964:366-367).

Although no complete astronomical compasses have been found intact in Polynesia there is evidence that they did exist. In 1831 Ellis wrote:

When setting out on a voyage, some particular star or constellation was selected as their guide in the night. This they call their aveia, and by this name they now designate the compass because it answers the same purpose (Lewis 1972:77).

The fundamental purpose of horizon stars in Polynesian navigation is to serve as reliable determinants of direction, for the setting and maintenance of constant and accurate courses at sea. They are not only useful when setting out for known targets but also during voyages of exploration as courses can simply be reversed. In summary Lewis wrote:

Of course, steering by horizon stars is as every bit as accurate as by magnetic compass and probably easier than trying to follow the gyrating compass card of an island schooner or a yacht. The snag is that, the navigator using the stars as we should a compass must be so thoroughly familiar with the night sky that he

can orientate himself when no more than one or two stars are visible, an ability shown repeatedly by both Tevake and Hipour (1972:81-82).

Zenith Stars

Zenith stars are utilised at their culmination on the meridian. They are able to be used to fix latitudinal position because their declination from the equator or azimuth is roughly equal to the European concept of latitude. They are additionally useful if the zenith occurs directly over the position of a known island (See Fig.43). The observation of such stars can be accurate to within thirty to sixty miles. The major difficulty lies with judging how far east or west the canoe is, as was found during the voyage of the *Rehu Moana* (See Chapter Four). This problem tends to even out once zenith observations over the target are made because of its proximity, and because other indices aid in the more precise fixing of its whereabouts (Gatty 1943:98; Frankel 1962:43; Lewis 1972:233-234; 244-246).

A good example of zenith star usage occurs in the Carolinian compass. Altair whose declination is eight point five degrees north, that is, it rises at eighty-one point five degrees east and sets at 278.5 degrees west is the cardinal point on that compass. What is significant is that Altair passes through the zenith of nearly every island in the 1,800 mile chain of the Caroline Islands (Lewis 1972:62-67).

Etak Islands

Another concept is the Micronesian system of 'etak' islands which involved the dividing up of a voyage into stages by astronomical reference to an etak island. A simple case is shown in the voyage from the island of Woleai to Olimaro (See Fig.44). If the navigator knows the bearing of a third reference or etak island, such as Faraulep, from both Woleai and Olimaro then they are able

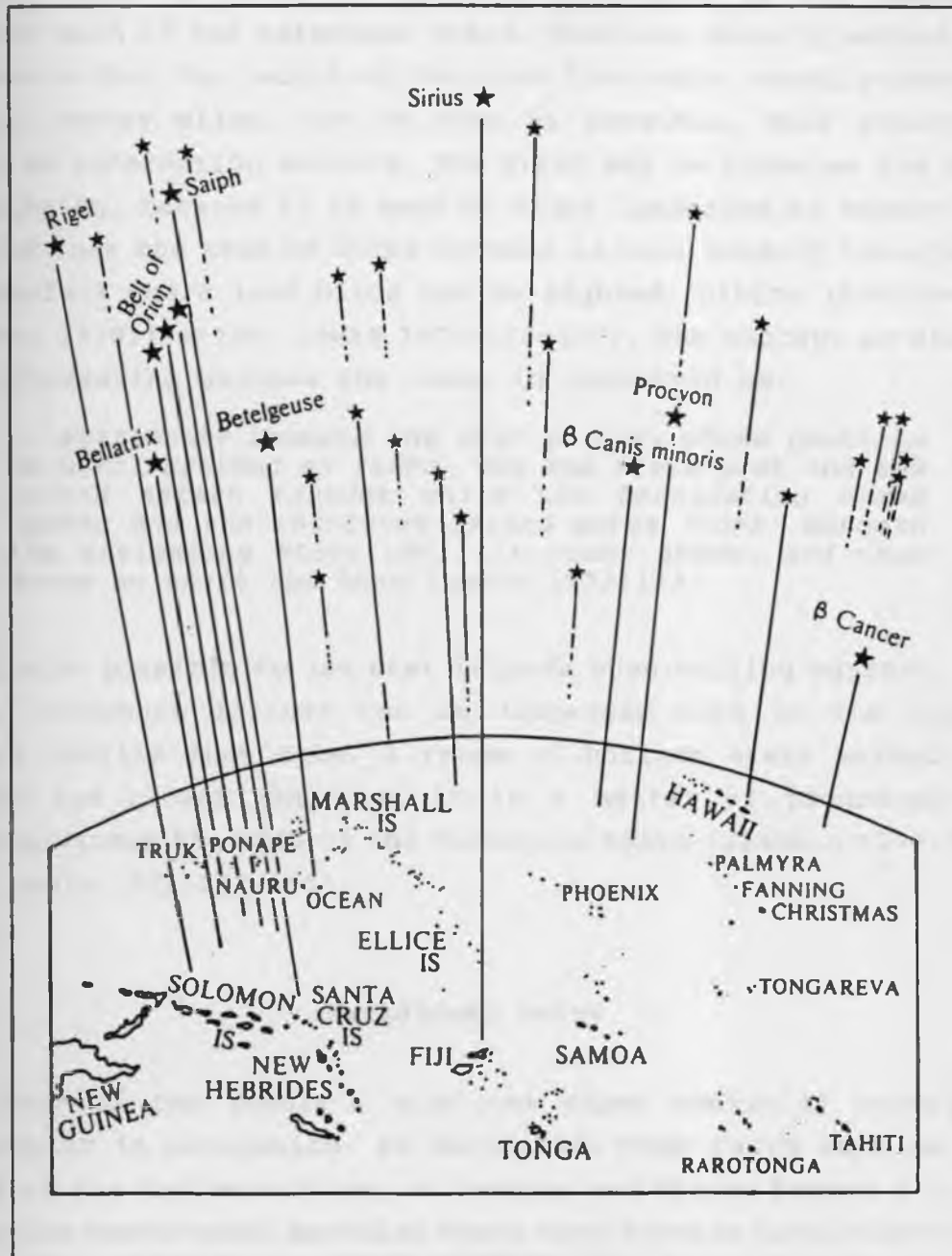


Figure 43: Zenith Stars in the Pacific (Lewis 1972:234).

to judge their position in relation to the backdrop of stars as shown. The navigator would also be able to assess the progress of the canoe in terms of distance according to the segments between each of the reference stars. Etak are usually worked out to ensure that the length of the etak intervals, usually between ten to twenty miles, are as even as possible. Etak intervals serve as information sectors. The first may be known as the etak of sighting, because it is used to sight landmarks at departure, and the last the etak of birds because it will usually lie closer to landfall where land birds can be sighted (Alkire 1970:50-55; Gladwin 1970:186-195; Lewis 1972:133-137). The concept is simple and interesting because the canoe is conceived as:

...stationary beneath the star points, whose position is also regarded as fixed. The sea flows past and the island astern recedes while the destination comes nearer and the reference island moves 'back' beneath the navigating stars until it comes abeam, and then moves on abaft the beam (Lewis 1972:134).

It is also possible to use etak islands when sailing against the wind. Reference islands can be dispensed with as the target island fulfils that role. A range of horizon stars beyond the target are chosen and then it is a matter of progressively tacking within the span of the reference stars (Gladwin 1970:189-195; Lewis 1972:139-140).

Meridional Pairs

The crew of the *Hokule'a* also use other naturally occurring principles in navigation. As Meridional Star Pairs such as the staff of the Southern Cross, or Canopus and Mirzam become aligned along the north-south meridian where they provide highly accurate indications of direction (See Chapters Five and Six). They can also be used to work out latitude. For example, when Acrux (the lowest star of the Southern Cross) is the same height above the horizon as it is beneath Gacrux (the upper star) then the observer is at twenty-one degrees north, the same latitude as Hawai'i. When Alioth is the same height above the horizon as it

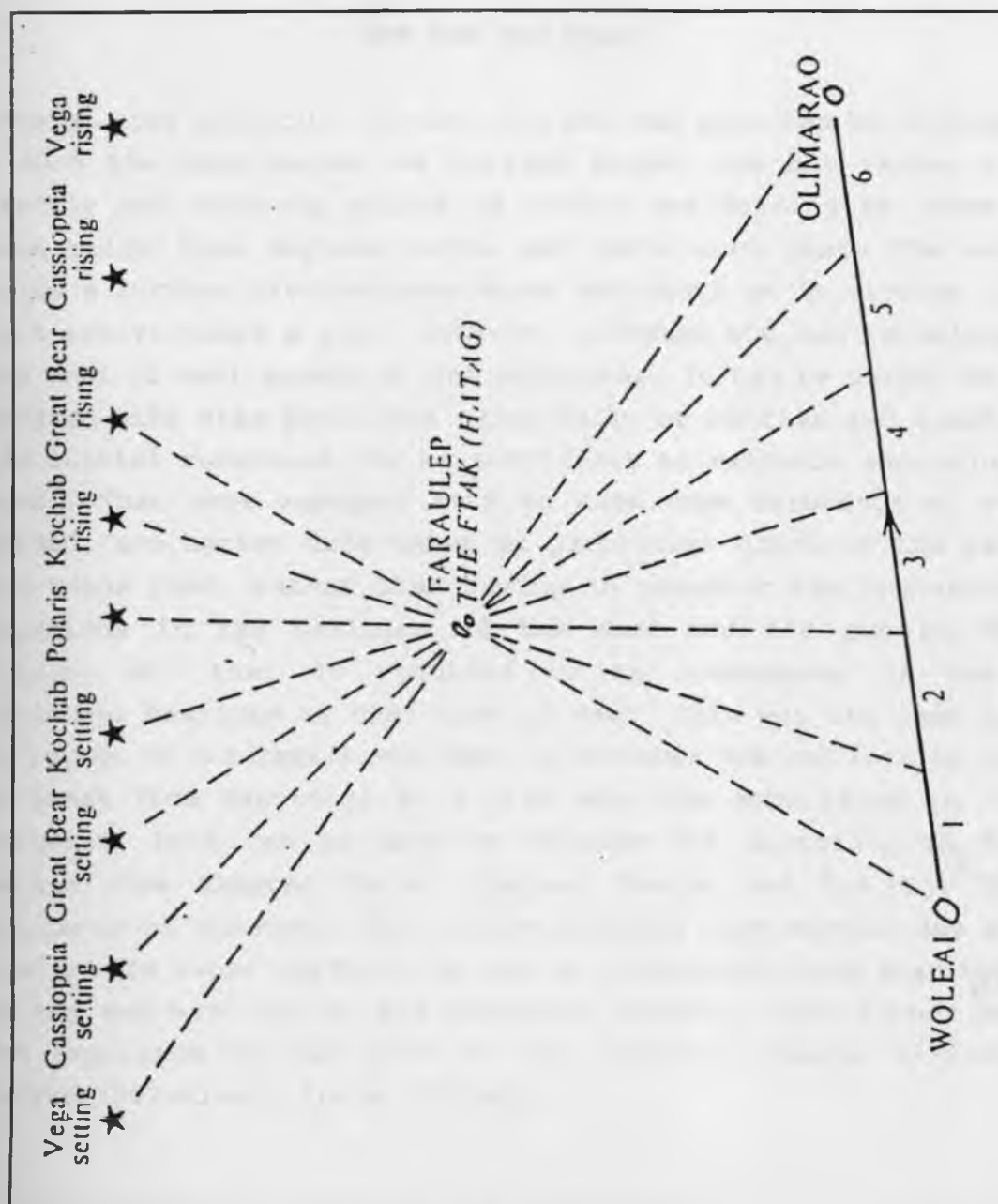


Figure 44: Etak Island Sailing from Woleai to Olimaro in Micronesia (Lewis 1972:136).

is below Cor Caroli then the observer is at the same latitude as Tahiti (Kyselka 1987:42-44).

The Sun and Moon

Although more difficult to use, the sun and moon can be utilised in much the same manner as horizon stars. The sun varies its easterly and westerly points of rising and setting by twenty-three point five degrees north and south each year. The moon varies a further five degrees north and south as it circles the earth twelve times a year. However, although the sun is neither true east or west except at the equinoxes, it can be useful when compared with star positions twice daily at sunrise and sunset. This initial reference can be sufficient to maintain and adjust course. That some voyages, such as that from Rarotonga to New Zealand, are better undertaken at particular times of the year also means that, rather than having to remember the year-round variations in the position of the moon and the sun on the horizon, all that is required to be remembered is their particular bearings at that time of year. This was the case for the voyage of the *Hawaikiniui* when in November the sun sets in the southwest from Rarotonga at a time when the moon rises in the northeast. Both can be used to adjudge the direction to New Zealand (See Chapter Seven, Chapter Twelve and Fig.45). The terminator of the moon, that is the dividing line between day and night on the lunar surface, is also a north-south line when both the sun and moon are on the celestial equator. This factor has been exploited by the crew of the *Hokule'a* (Lewis 1972:83; Kyselka 1987:41-42; Irwin 1992:45).

Sea Swells

Direction can also be maintained according to sea swell patterns. The predominant east, north-east or south-east Pacific swells are created by the strong and persistent trade winds.



Figure 45: 'Steer to the Left of the Setting Sun'. The *Hawaikinui*, Following Kupe's Directions, Uses the Seasonal Position of the Sun to Head for New Zealand.

Another major source lies in the southern ocean belt of strong westerlies from whence long southerly swells sweep north over the equator. Swells are distinct from 'waves' which are caused by more temporary and variable winds, and are distinguishable by such characteristics as having breaking crests. Swells vary in height, length, shape and speed and form constant long term observable patterns, detectable by observation and 'feel'. The manner in which a swell strikes the canoe causes it to rock, pitch or corkscrew in unique patterns (See Fig.46). Courses can be maintained by keeping the canoe at a constant angle to the swell. Sudden changes in the motion of the canoe indicate that it is off course (Lewis 1972:82-93; Kane et al 1984:105).

Wind Patterns

The predominant wind patterns of Polynesia are also useful for determining direction in much the same way as sea swells because of their consistency. Several wind compasses are extant, including examples from Pukapuka, Fiji and Rarotonga (See Fig.47). As shown on the *Hawaikinui* (Chapter Seven) pennants were flown from masts so that changes in wind direction were easily observable by changes in the angle at which pennants flew (Lewis 1972:73-74, 93-95).

Longitude and Dead Reckoning

The parallels of latitude represent equidistant concentric circles relative to the poles while the meridians of longitude decrease in distance as one moves away from the equator and converge at each of the poles. The key factor in measuring longitude is time. In European navigation the chronometer was not introduced until the time of Cook. Prior to its introduction measurements were made between the moon and known stars. The resultant angle gives an estimate of elapsed time based on the moons progress through the stars of about thirteen degrees every

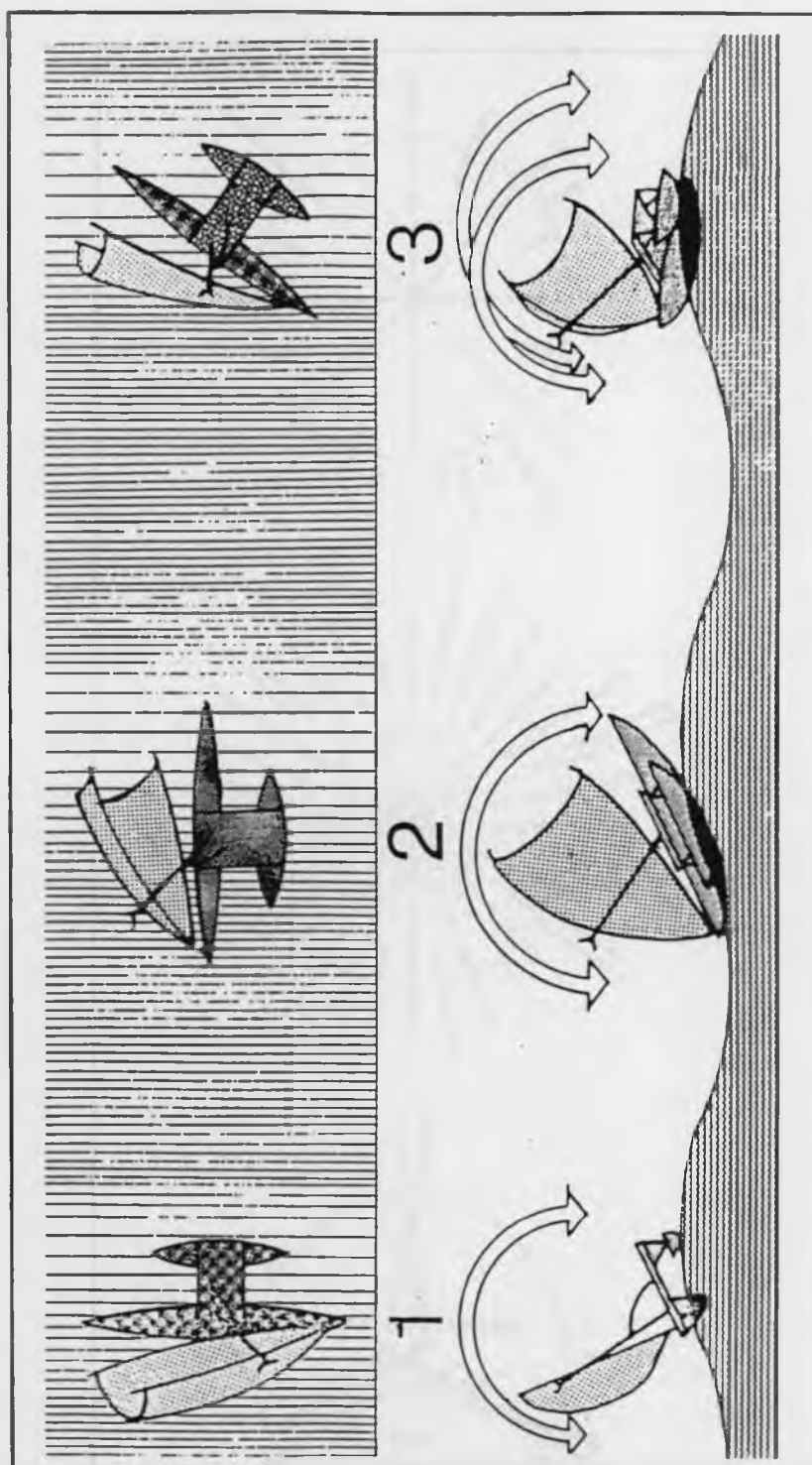


Figure 46: 1. Rocking in Crossing Swell
2. Pitching in Following or Heading Swell
3. Corkscrewing Along Angled Swells (Kane et al 1984:105).

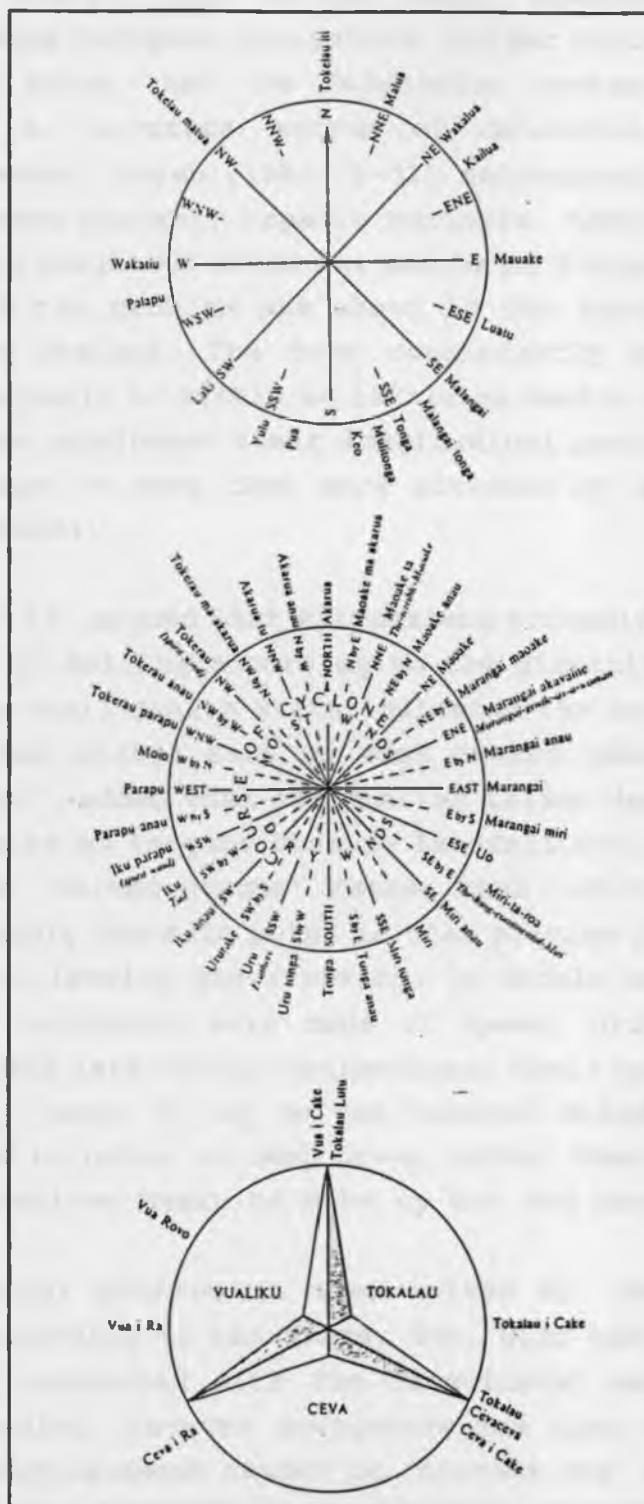


Figure 47: Wind Compasses from Pukapuka, Rarotonga and Fiji (Lewis 1972:76).

twenty-four hours. This method was, however, notoriously inaccurate among European navigators (Hilder 1962:95-96). It has already been shown that the Polynesian system of navigation incorporates an accurate method of determining latitudinal position. However, Heyen (1962:70-71) maintained that, although Polynesians were probably capable mariners, they were incapable of determining longitude after the manner of European navigation. An example of the problem was shown in the voyage of the *Rehu Moana* to New Zealand. The crew consistently estimated their latitude accurately to within as little as twelve miles. However, they also often misjudged their longitudinal position in respect of how far east or west they were situated by up to 200 miles (Lewis 1966:84-94).

Frankel (1962:43) argued that Polynesians probably overcame these difficulties by sailing according to the directions supplied by horizon stars until zenith stars indicated the correct latitude, and then turned either east or west toward their destination. Lewis (1964:367) added that the smaller island destinations were enhanced in size as targets because landfall over long distances took place on 'island groups' rather than individually smaller targets. Possibly the main point is that precise location is less important than leaving and arriving. It should be noted that on the *Hokule'a* estimates were made of speed, drift, and set in conjunction with latitudinal estimations. Their calculations were often also in error by up to one hundred miles. However, the errors tended to occur in deep ocean rather than closer to land where other indices begin to make up for the shortfall at sea.

The longitudinal problem is also solved by 'dead reckoning'. Navigation according to the stars, sun, wind and swell patterns is primarily concerned with the directional maintenance of a course or heading. However navigators are also confronted with problems of displacement caused by 'current set' and 'leeway' or 'wind drift'. The techniques of estimating this displacement are referred to as dead reckoning (Lewis 1972:99-100). Dead reckoning has two elements, direction and distance. Direction is the

maintenance of a controlled course taking into account set and leeway, while distance is calculated by estimates of speed and time (Irwin 1992:46).

The predominating Pacific currents are very consistent so that any variations in set tend to occur over shorter intervals of time. The cumulative affect of these variations tends to cancel itself out over longer periods. During the *Rehu Moana's* voyage to New Zealand their estimates of distance travelled each twenty-four hour period erred as much as forty miles, yet over a one month period covering 1,600 miles the total error was only seventy-seven miles (Lewis 1972:104).

Currents, their variations and relationship to wind patterns, were studied and known by navigators both within and between their respective island groups. Experienced navigators were:

...familiar with such home centred observations and trained also in more general deep sea lore like the relationship between currents and prevailing winds, would be well able to couple together the two sets of data. His deductions would enable him to head out across unfamiliar waters with a reasonable idea of the current set likely to be encountered. In this he would be aided in no small measure by the aforementioned tendency for heading errors due to short term current fluctuations to neutralise each other (Lewis 1972:104-105).

Courses were planned on shore before departing, that already took into account a known amount of displacement caused by current set. This could involve choosing different sets of landmark back-sights or star paths in order to allow for set and drift (See Fig.48)(Lewis 1972:108; Kane et al 1984:104).

At sea set and leeway was estimated by sighting back along the centre line of the canoe and observing the angle between the wake and the projection of the course being steered. A combination of other factors which were reckoned when allowing for leeway, including the efficiency of the keel at resisting displacement, the angle of the craft to the wind, the height and steepness of the waves. A fifteen degree leeway and adjustment for course was

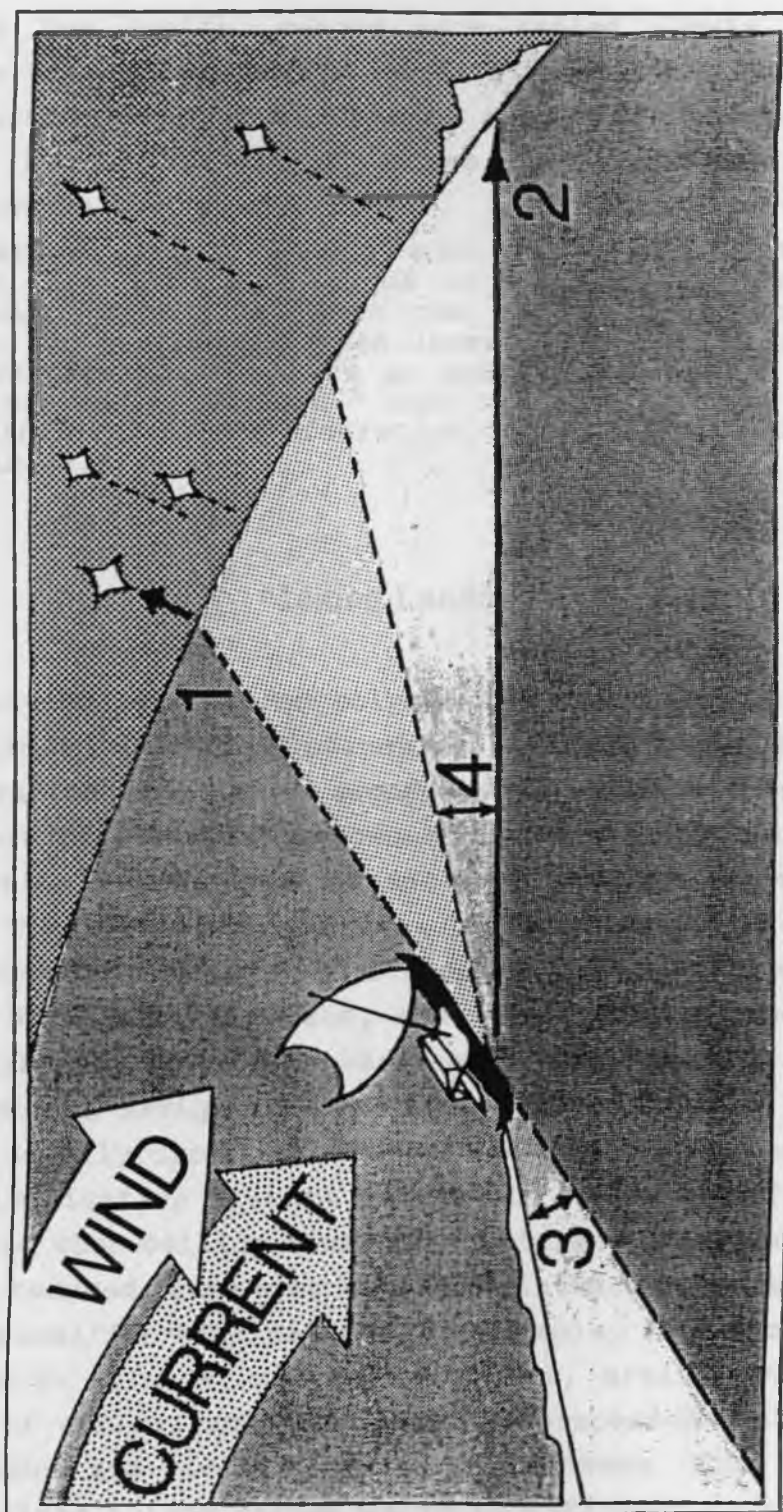


Figure 48: Setting a Star Path to allow for Set and Drift (Kane et al 1984:104).

typical of how Pacific canoes were sailed (Lewis 1972:116). During one voyage between the Reef Islands and Taumako, Tevake had instructed Lewis of two stars, twenty-four degrees apart, that were guides for their course. In response to Lewis's question Tevake explained:

You steer by Sirius only when the wind is in the south, for then your canoe is close hauled on the starboard tack (i.e. with the wind coming from the right, or starboard), when leeway plus wind drift of the surface water set it so sharply off course - he made a skidding gesture - that to compensate you must make this (24 degree alteration of course to starboard (Lewis 1972:48).

Making Landfall

Deep sea navigation enabled Polynesian seafarers to sail within close proximity of their destinations where they could resort to the observation of natural signposts in order to locate their targets more precisely. The combination of a number of indices, in conjunction with the land masses they surround, form 'expanded targets'. These expanded targets, in congregation, form larger 'island blocks and screens' (See Fig.49). Even very small atolls, which are difficult to locate, are on average, expandable by a radius of about thirty miles when natural indices are taken into account. Once a navigator is within this range then the island itself is usually directly locatable by sight or other indices. The main implication of this concept is that the difficulty of finding land when sailing toward large island blocks and screens is greatly reduced, even over extended distances (Lewis 1972:153-155). The Hawai'ian archipelago, for example, is composed of 340 miles of high islands up to 13,000 feet, active volcanoes, a multitude of atolls, shoals, reefs, interspersed with a number of wind shadow and wave interference phenomena. Thus it forms a 1,000 mile long island screen which is difficult to miss (Lewis 1964:369).

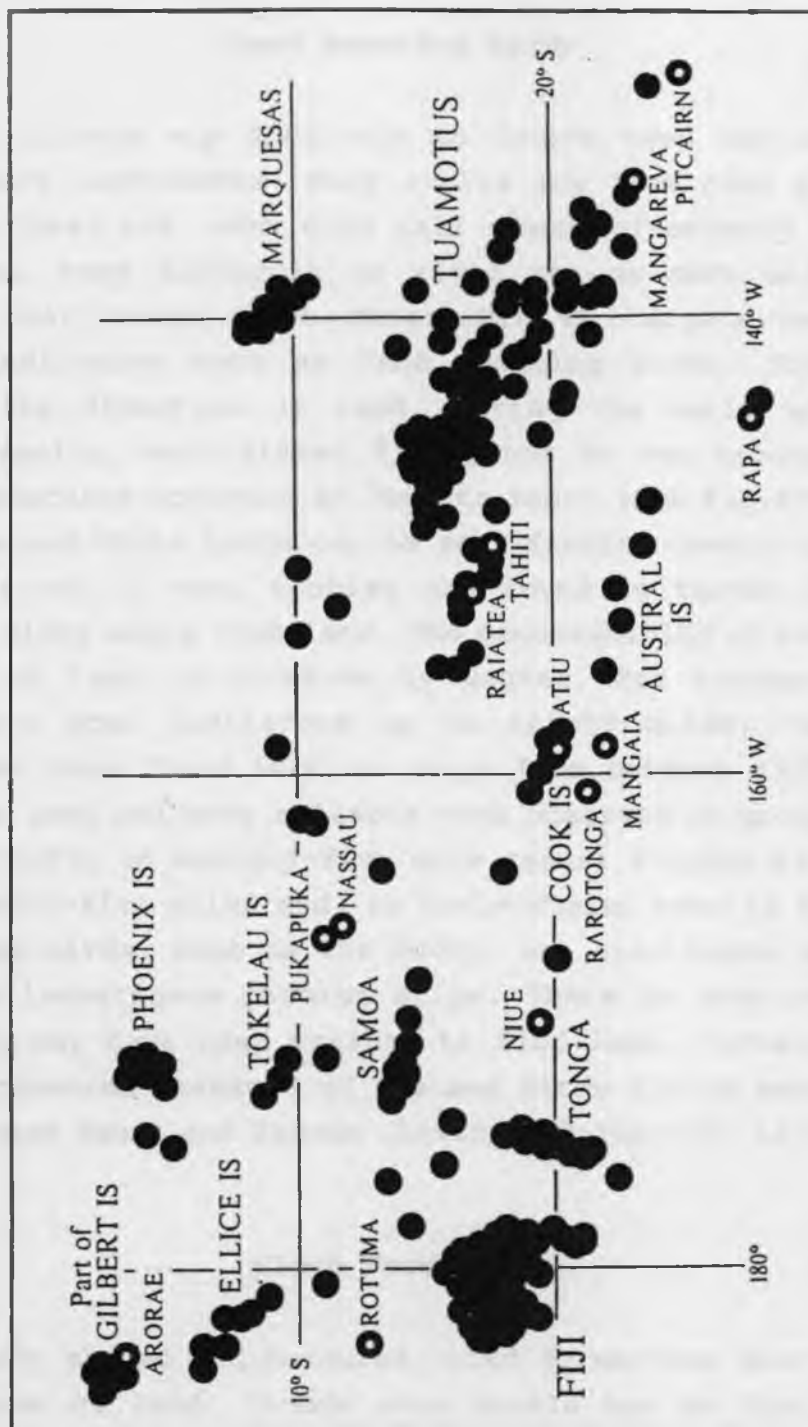


Figure 49: Expanded Targets, Island Blocks and Screens Formed by Drawing a Thirty Mile Radius Around Each Island. In this Diagram Height has been Ignored (Lewis 1972:152).

Land Roosting Birds

Low coral islands are difficult to locate even for navigators using modern instruments. Many atolls are less than two meters above sea level and, even with tall stands of seventy foot high palm trees, very difficult to sight ten or more miles away. However, they become more detectable as targets because of natural indicators such as land roosting birds. These birds indicate the direction of land, during the early morning or towards evening, when either flying out to sea around dawn to fish or returning homeward at dusk to roost (See Fig.50). Flocks of noddies and white terns can be seen fishing twenty to twenty-five miles out to sea. Boobies are found in threes and fours thirty to fifty miles from land. The dependability of these birds as signs of land is relative by degree. For instance, brown boobies are good indicators up to thirty miles; red footed boobies and blue faced boobies range from between fifty to 100 miles from land and more reliable when observed in groups within a shorter fifty to seventy-five mile range; frigate birds range up to seventy-five miles and, as individuals, even as far as 150 miles. Some birds, such as the booby, are also known to fly out to sea to investigate passing ships. There is some suggestion that birds may have been trained to find land. Certainly there is one documented instance of trained birds flying messages 160 miles between Nauru and Banada (Lewis 1972:162-173; 1976:22-23).

Cloud Formations

Particularly shaped and coloured cloud formations also indicate the presence of land. Clouds over atolls may be distinctively coloured and brighter than other cloud covering, because of the reflection of the lagoon or atoll on the cloud base. The colour and brightness of these clouds becomes more apparent when nearing land beneath the horizon and is distinguishable from between fifteen to seventeen miles distant. The cloud roof over lagoon

islands may be greenish or even pink depending on the colour of the reef, whitish or very bright over expanses of white sand or surf, brightly coloured over islands with large stretches of dry reef or mangrove, and dark over wooded islands. The 'brightness' of the cloud may be more striking than its colour (Lewis 1972:173-176).

Another characteristic of land cloud is that it tends to move more slowly over land in comparison to clouds over the open sea. Land cloud also appears to be more stationary, or alternatively breaks up and reforms over the island in cycles. During windy weather and during conditions of scattered cloud, 'V' shaped clouds are observable hanging above small islands. During calm conditions and in the absence of other cloud an 'eyebrow' pattern is characteristic (See Fig.51). V shaped formations may move about, dissipate and reform, but the position of the funnel end of the V remains constantly fixed over the land beneath. In fine calm weather the 'loom', a pale shimmering column of projected glare, is reflected into the air above an atoll and its lagoon. This can be seen at thirty miles distance and is often also observable at night (Lewis 1972:175-180).

High volcanic islands, such as Tahiti which stands 7,400 feet high, can usually be seen at eighty miles distance. However, when covered with high standing cumulus cloud it is detectable beyond one hundred miles. The case is similar for Hawai'i. These distinctive clouds are precipitated by the action of prevailing easterly trade winds which cause large volumes of condensation to rise and form above the high islands. Another characteristic effect of this high cloud is that it tends to trail downwind from high islands in flag-like fashion. During overcast conditions the nimbus over a high island may also be thicker, blacker and more concentrated than surrounding cloud. During rainy conditions, and especially when there is little or no moonlight, the loom of a wet island can be seen up to thirty miles (Lewis 1964:369; 1972:178-180).

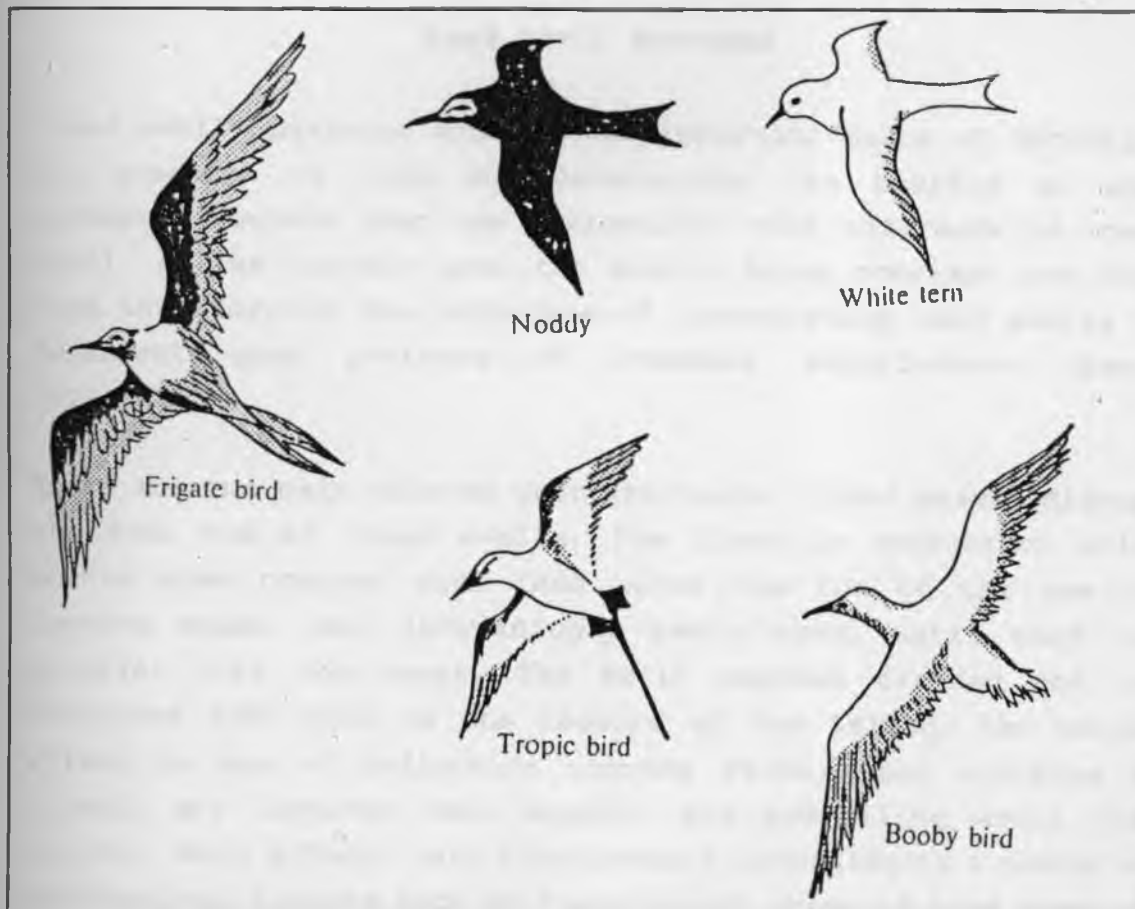


Figure 50: Land Roosting Birds (Lewis 1972:163-166).

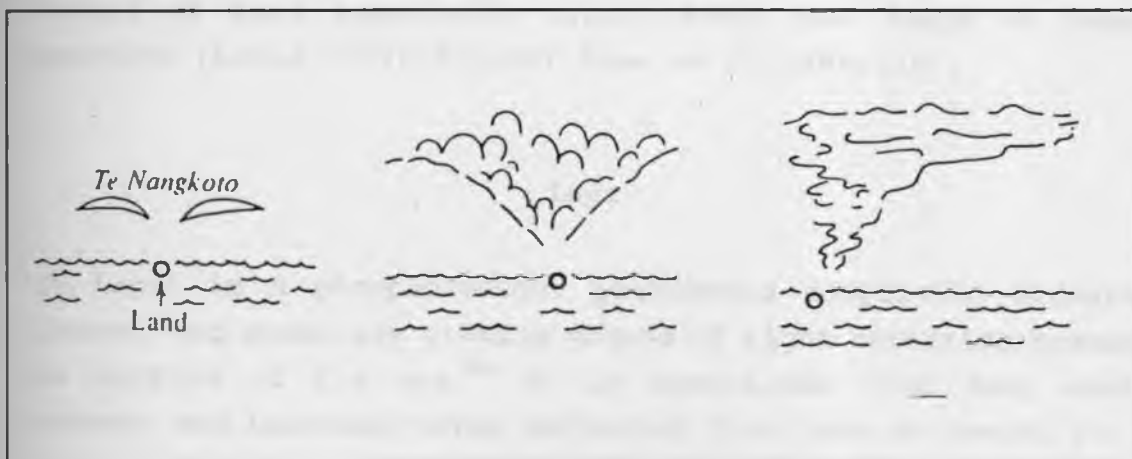


Figure 51: Eyebrow and 'V' Shaped Clouds (Lewis 1972:175).

Land Swell Patterns

'Land swell' patterns are another important means of detecting the presence of land and determining its bearing at some distance. Whereas deep sea navigation, with reference to ocean swell, relies largely upon the swells being constant and free from interference the technique of interpreting land swells is dependent upon patterns of landmass interference (Lewis 1972:181).

There are two main effects when obtrusive island masses disrupt the even run of ocean swells. The first is refraction which occurs when contact with land slows the run of the swell's inshore edges, and increasingly bends them, until they run parallel with the coast. The swell becomes divided and its refracted ends meet to the leeward of the island. The second effect is one of reflection whereby waves, upon striking an island, are inverted back against the prevailing swell (See Fig.52). Both effects vary considerably according to a number of geographical factors such as the size and shape of land mass and the number and direction of swells. Experienced navigators know the prevailing current patterns and are able to detect these variations. This allows them to deduce the proximity and likely bearing of land especially within their own range of usual operation (Lewis 1972:181-208; Kane et al 1984:106).

Lapa

'Te Lapa' is a phosphorescent phenomenon comprising streaks, flashes, and momentary glowing paques of light occurring beneath the surface of the sea.³⁶ It is associated with deep swell movement and backwash waves reflected from land or reefs. It

³⁶ 'Te Lapa' is a Polynesian Outlier term from the Santa Cruz Islands. 'Te Mata' and 'Ulo Aetahi' are Micronesian terms for the same phenomena (Lewis 1972:210-211).

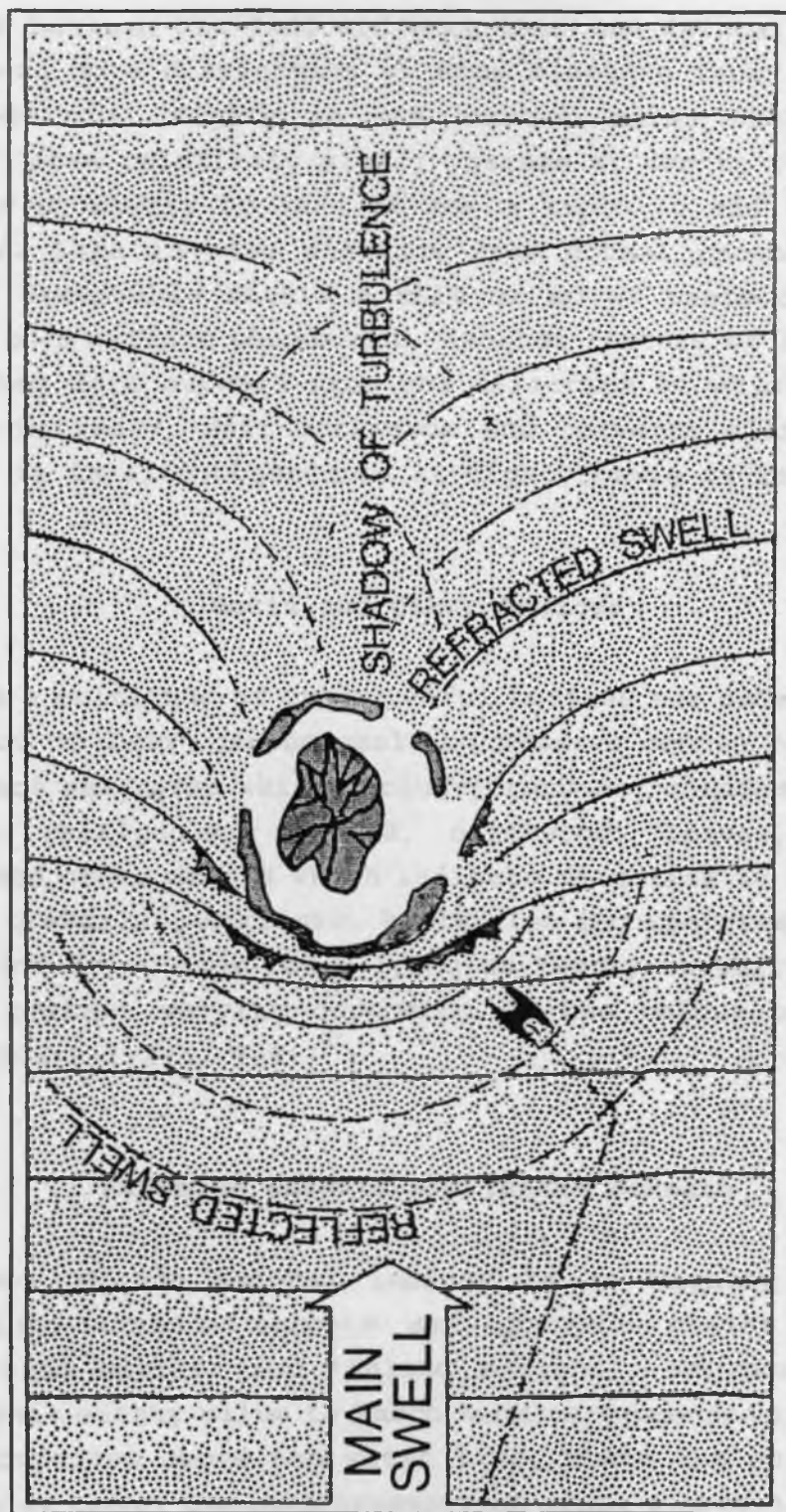


Figure 52: Reflected and Refracted Swell Patterns (Kane et al 1984:106).

begins about eight to nine miles out from shore and is seen at depths of between one foot and more than one fathom. It is also clearer and more distinctive at some distance from land rather than closer. At eighty to one hundred miles from land the 'flashes' move relatively slowly whereas at ten to twenty miles in closer proximity to land it has a rapid to and fro jerking character. Lapa is also distinct from normal phosphorescence, which is observable within a mile or so of reefs or land and tends to be a surface phenomenon. Another feature of lapa is that the flashes dart outward from the direction at which land lies or, alternatively, dart backwards and forwards along the same bearing. It is also observable at night (Lewis 1972:208-211).

Betia and Other Indices

There are a multitude of other useful indices for detecting land; the 'scent of land' can be smelt on breezes coming off islands. 'betia' are sea marks which include; rubbish, changes in species of fish, whirlpools, seaweed, driftwood, leaves, branches, rubbish and other debris which indicate direction in conjunction with the prevailing currents. Betia also incorporates sea colour changes occurring over reefs lying at twenty to thirty fathoms, the hue perhaps varying depending on the colour of the reef (Lewis 1972:211-215, 249).³⁷

Expanded Targets and Island Screens

The affect of the natural indices is to magnify individual islands into 'expanded targets' and, groups or chains of islands, into 'island blocks' and 'island screens'. For example, some Samoans sail eighty miles to Pasco Bank, a submerged reef without any protrudences above the water line, where the colour change in the water above the reef presents an eight degree navigational

³⁷ 'Betia' is a Gilbert Islands term (Lewis 1972:249).

target that to an experienced eye was virtually impossible to miss. The trade routes between Pukapuka, Samoa, Tokelau and Niue, for basaltic stone, as documented by Beaglehole (1938), provide another good example. From Niue to Pukapuka the distance is 530 miles and the expanded target, including Tema Reef and Nassau, presents a screen to aim at of between ten to twelve degrees. The expanded arc of the Pukapuka to Niue return is eight to nine degrees because of the presence of boobies. From Pukapuka to Samoa the distance is 370 miles and the arc of landfall, because of the number of sightable high islands, twenty-two degrees. The return from Samoa to Pukapuka via Swains Island provides an expanded arc of fifteen degrees at Swains Island, because of the Tokelau Island Screen in to the north and leeward, and an arc of fourteen degrees from there to Pukapuka. The margin of safety for successful landfall, at least somewhere, is high (See Fig.53)(Lewis 1972:224-231).

Other examples abound. When sailing toward the Southern Cooks the navigator is able to aim at an island screen that runs 200 miles east to west, and 120 miles north to south. When sailing toward Fiji, Tonga and Samoa a mariner is at worse going to strike something because the islands form an extended screen 700 miles north to south, and 700 miles east to west (Lewis 1972:154).

Summary

The Polynesian Navigation System incorporates three aspects including setting course, navigating at sea and making successful landfall. The three elements depend on the observation of natural indicators including the stars, the sun, the moon, wind, swells, birds, clouds and other noticeable phenomena. The model works best when the information from a variety of indices is combined. When worked correctly courses can be set that allow for a safe return if required. Direction can be maintained over very long distances and although traditional methods of judging distance are less accurate than those for judging latitude the errors tend

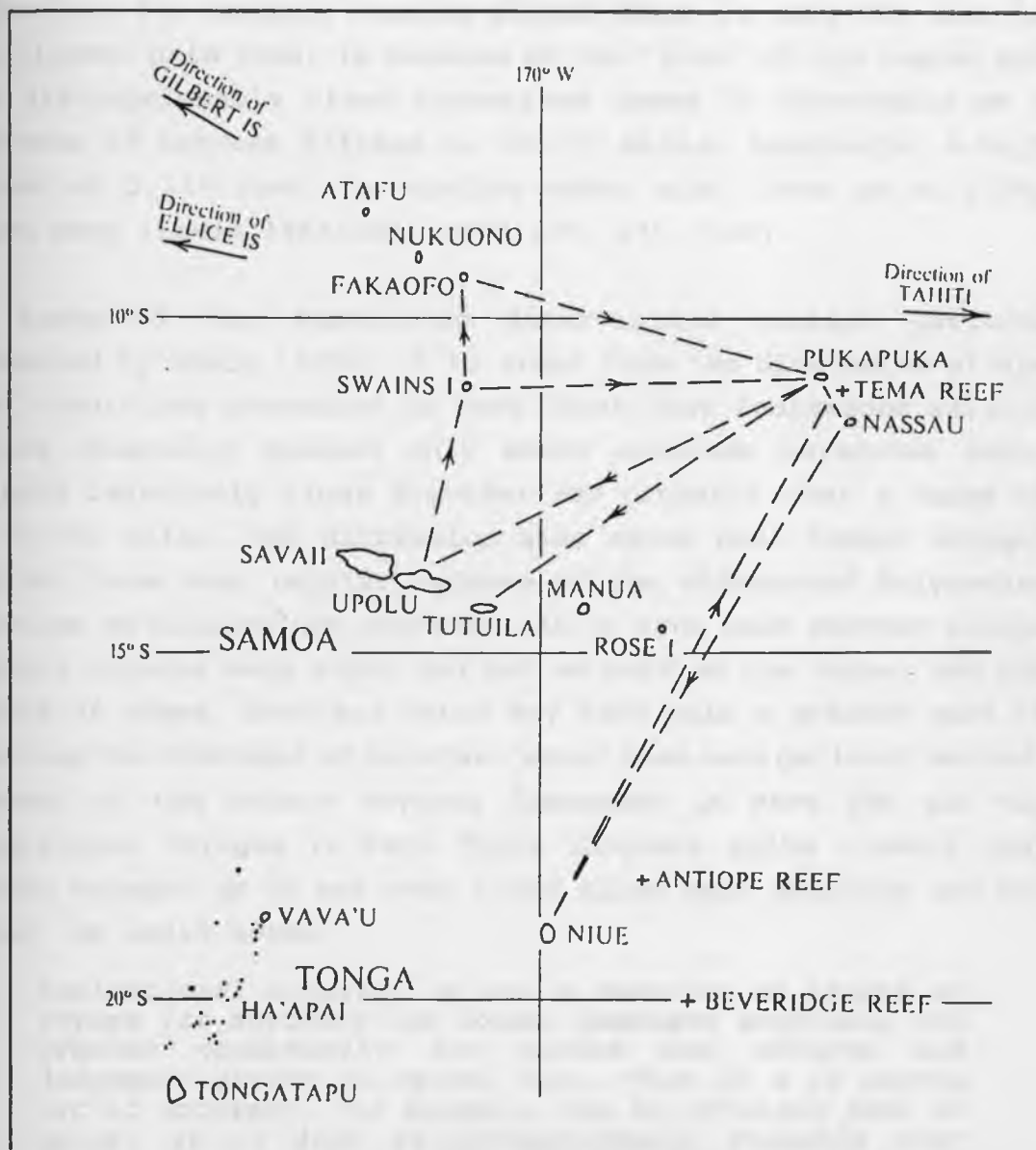


Figure 53: Expanded Target Angles between Pukapuka and West Polynesia (Lewis 1972:224).

to cancel out over long distances. The proximity of natural land indicators reduces the margin of error as does the angle of the expanded target. Traditional methods of locating land are on average effective from between thirty to eighty miles from the objective. For example Fanning Island which is only 100 feet to the highest palm tree, is because of the 'loom' of its lagoon and the distinguishable cloud formations above it detectable at a distance of between fifteen to thirty miles. Rarotonga, a high island of 2,110 feet, is visible under high cloud up to fifty miles away (Lewis 1964:369; 1972:125, 179, 223).

In terms of the restricted inter-island contact patterns advocated by Sharp (1956) it is clear from the discussion of the oral traditions presented in Part Three that indigenous sailing routes generally spanned only short unbroken stretches among islands relatively close together and probably over a range of up to 500 miles. The discussion also shows that longer voyages may not have been regular because of the widespread Polynesian practice of killing new arrivals. It is true that shorter island hopping voyages were safer and not as hard on the canoe, and the limits of crews, food and water may have paid a greater part in limiting the distance of voyages rather than navigational method. Several of the modern voyages discussed in Part Two and the traditional voyages in Part Three indicate quite clearly that longer voyages up to and over 1,000 miles were possible and did occur. As Lewis noted:

Navigational accuracy is not a function of length of voyage (if anything the longer passages providing the greater opportunity for random sea effects and judgement errors to cancel out). Thus if a 15 degree arc of accuracy, for example, can be attained over 30 miles, it is just as navigationally feasible over 1,000. The special problems of the longer journey concern such factors as food supply, man power, motivation, and strength of the vessel-not navigation (1972:223).

CHAPTER FOURTEEN

WAKA DESIGN AND CONSTRUCTION

The summary at the beginning of Chapter Nine outlined the evolution of the Polynesian Navigation System. It also discussed the early parallel development of Polynesian ocean going craft from their beginnings as small rafts. This chapter presents a concise and detailed summary of the design and construction of the main types of ocean going Polynesian double-hulled canoes as they were at the time of the arrival of the Europeans.

The word 'canoe' is not an entirely appropriate term to describe the deep sea vessels of the Polynesians. It invokes the picture of a tiny craft struggling against the elements. Many Polynesian vessels as noted by Parsonson (1962:36-37) were longer than one hundred feet in length. The deep sea craft of the Micronesians and Polynesians were generally large double-hulled vessels, or smaller with an outrigger on one side, or with outriggers on both sides. Double outriggers were mainly used in the waters of Indonesia and the Indian Ocean. Single outriggers were used in Micronesia. There is only one confirmation of bigger double-hulled vessels being used in Micronesia, and that is from Truk in the Caroline Islands. The only deep sea outriggers in use in Polynesia were from Pukapuka and the Marquesas. However, these were generally much larger than their Micronesian counterparts. The larger double-hulled canoes of Hawai'i, Tahiti, the Tuamotu and Cook Islands were the mainstays of Polynesian navigation. The main reasons for the variations among each region relate to available materials, carrying capacity, distance of sailing, sea

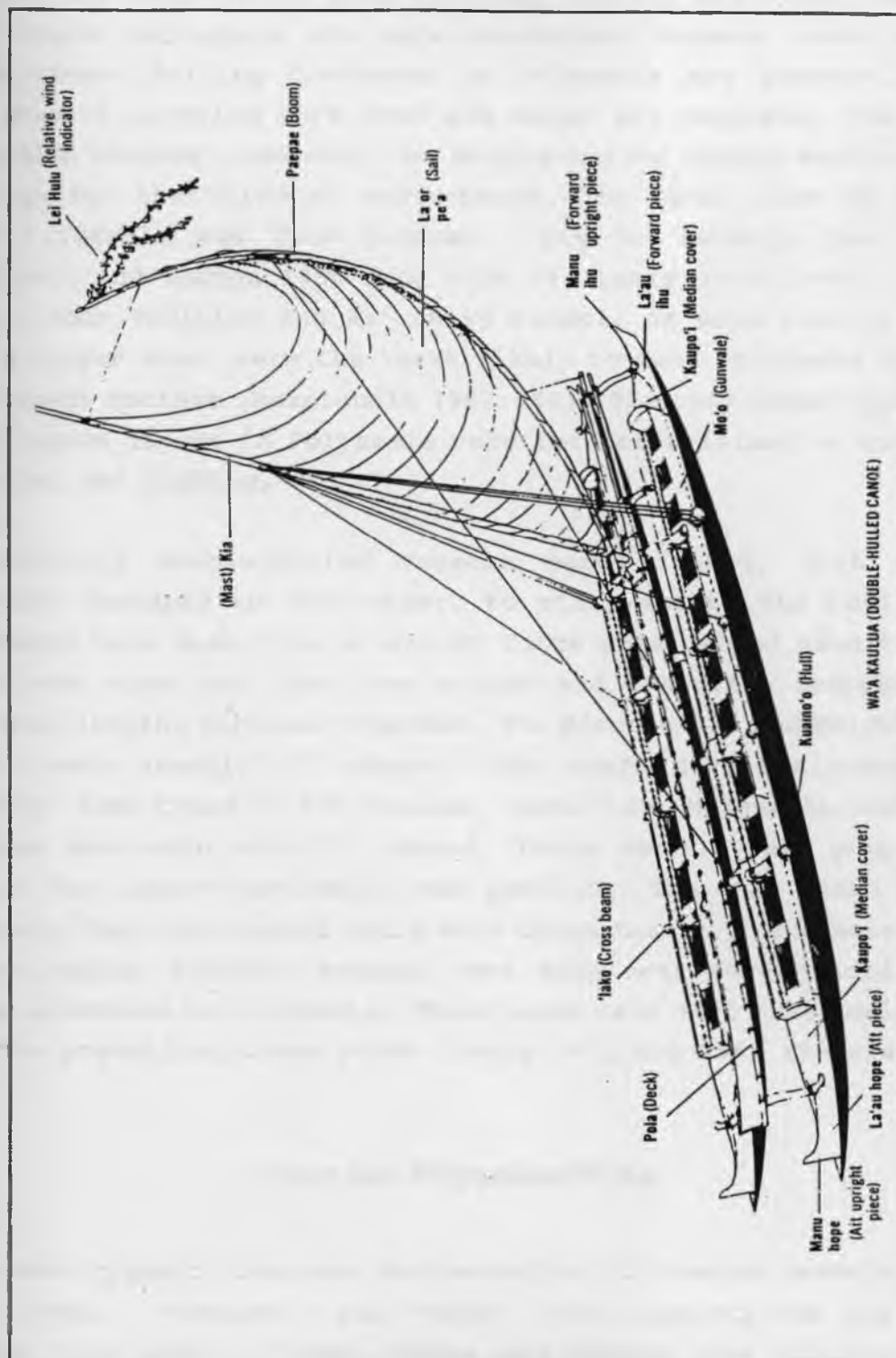


Figure 54: Hawai'ian Double-Hulled Waka (Hunt and Kelly 1984:55).

and weather conditions. The Indian, Indonesian and Micronesian Oceans are more placid than the deep Pacific and light, double or single outriggers are safe convenient vessels under those conditions. Sailing distances in Polynesia are greater. Waka capable of carrying more food and water are required. The seas are also rougher, and only the double-hulled canoes were stable enough for that kind of environment. The usual size of ocean going vessels was from between fifty to seventy feet long (Hornell and Haddon 1936:326, 1938:43; Lewis 1994:53-55). Cook noted that Tahitian and Ra'iatean vessels of this size, rather than larger ones, were the least likely to meet accidents during inclement weather (Beaglehole 1962:366). The only other types of outriggers in use in Polynesia were for inter-island or coastal trading and fishing.

Essentially double-hulled vessels were planked, with broad strakes fastened to each other, to ribs, and to the keel. The lashings were made from a coconut fibre rope called sennit. The keel was adzed out from tree trunks and was often composed of several lengths fastened together. The Micronesian and Polynesian hulls were usually 'V' shaped. This shape gave resistance to leeway. Some types of New Zealand, Hawai'ian, Marquesan and Cook Island waka were more 'U' shaped. These vessels were purposely built for inshore navigation and paddling. The only ocean going vessels that had rounded hulls were those from Fiji and Melanesia where medium distance voyages were made over more placid seas than elsewhere in Polynesia. These areas were also less dominated by the prevailing trade winds (Lewis 1972:254-256; 1994:54-55).

Deep-Sea Polynesian Waka

The main types of deep sea double-hulled Polynesian vessels were the 'pahi', 'tongiaki' and 'ndrua'. The tongiaki was the main canoe type used in Tonga, Samoa and Rotuma (See Fig.55). The hulls were of equal length and usually carried a sizable platform. Fires were often kept burning on the deck. These were

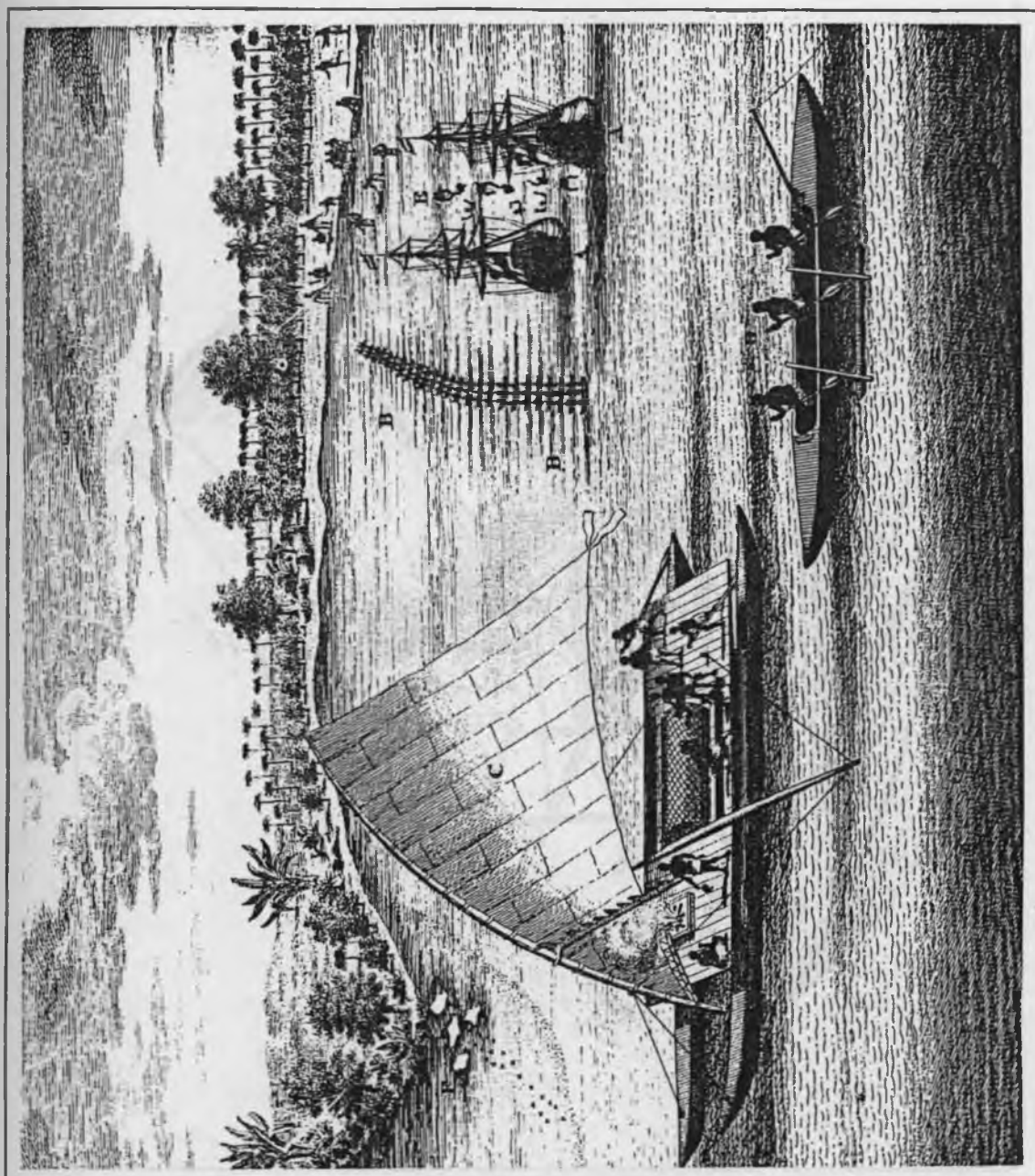


Figure 55: Tongiaki Waka from Tonga (Lewis 1994:58).

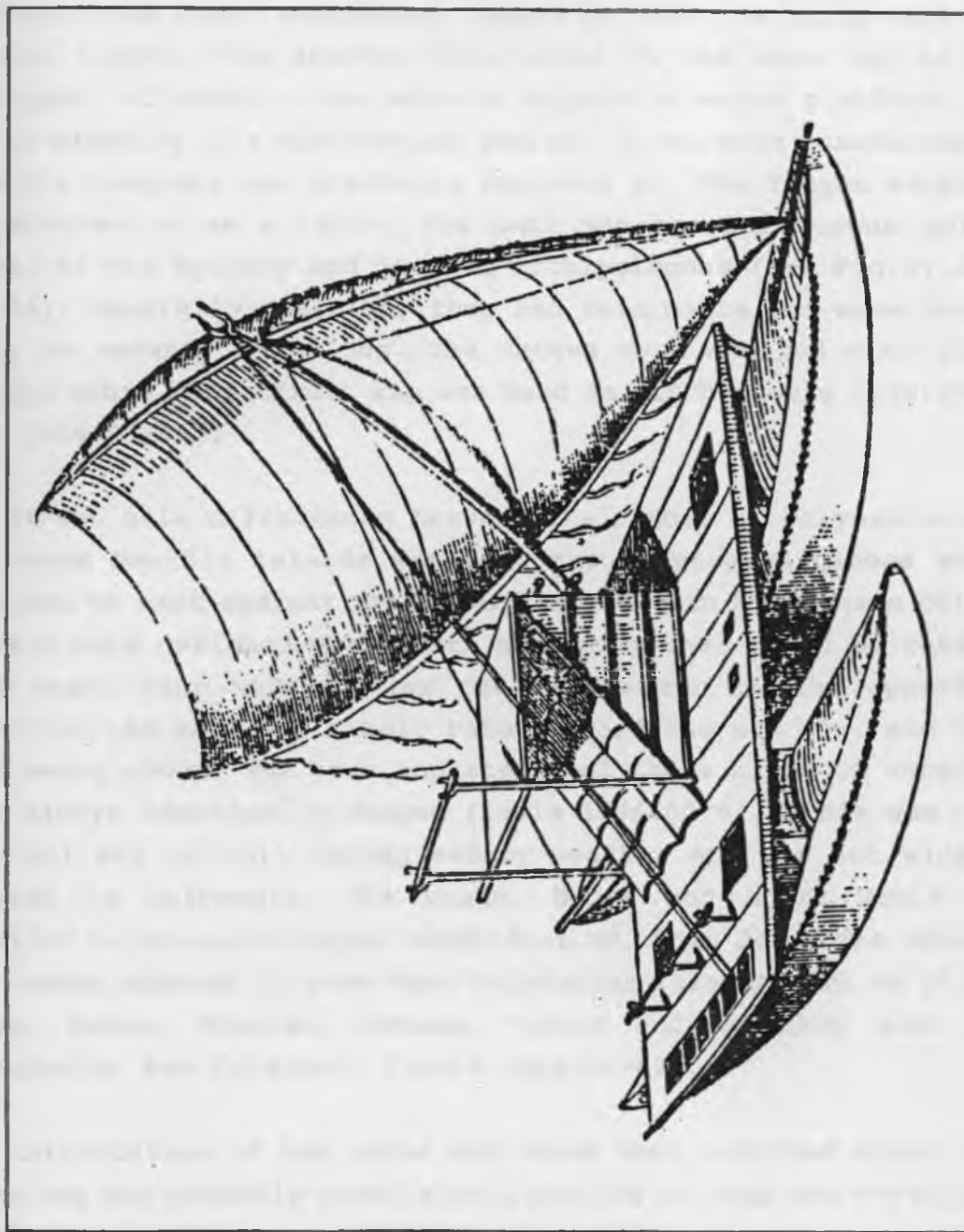


Figure 56: Fijian Ndrua (Lewis 1994:59).

lit on platforms of coral, gravel, stone or clay (Lewis 1994:57).

The main type of Fijian canoe was the ndrua (See Fig 56). It differed from other Polynesian canoes in that the hulls were of unequal length. The shorter hull acted in the same way as an outrigger, although it was able to support a larger platform. It was an adaption of a Micronesian design. It was more manoeuvrable than the tongiaki and gradually replaced it. The Tongan version is referred to as a kalia. The pahi was the main ocean going vessel of the Society and Tuamotu archipelagoes (See Fig.57 and Fig.58). Generally speaking, they had twin masts and were about fifty to seventy feet long. The canoes were caulked with fine coconut fibre. Breadfruit sap was used as pitch (Lewis 1972:256-257, 1994:56-58).

One of the main differences between the canoes of Polynesia and the other Pacific islands was that the Polynesian canoes were designed to tack against the wind. Elsewhere in Micronesia other vessels were designed with masts and sails that could be raked. This meant that when it was desired to run in the opposite direction the mast was simply raked toward the new bow, and the sail swung about. The bows and sterns of these kinds of vessels were always identically shaped (Lewis 1994:60-61). This was not an ideal way to sail during stormy weather and was not widely adopted in Polynesia. The masts, booms and spars would be unsuited to the more rugged conditions of those seas. The system did become adopted in some West Polynesian islands such as Fiji, Tonga, Samoa, Tokelau, Rotuma, Tuvalu and possibly also in Micronesian New Caledonia (Lewis 1994:61-62).

The introduction of the ndrua and raked mast occurred about 200 years ago and probably paralleled a decline in deep sea voyaging. These craft would be suitable for inter-island voyaging within the West Polynesian region but would not be suited to long deep sea voyaging, especially in high seas and when sailing to windward against the trades.

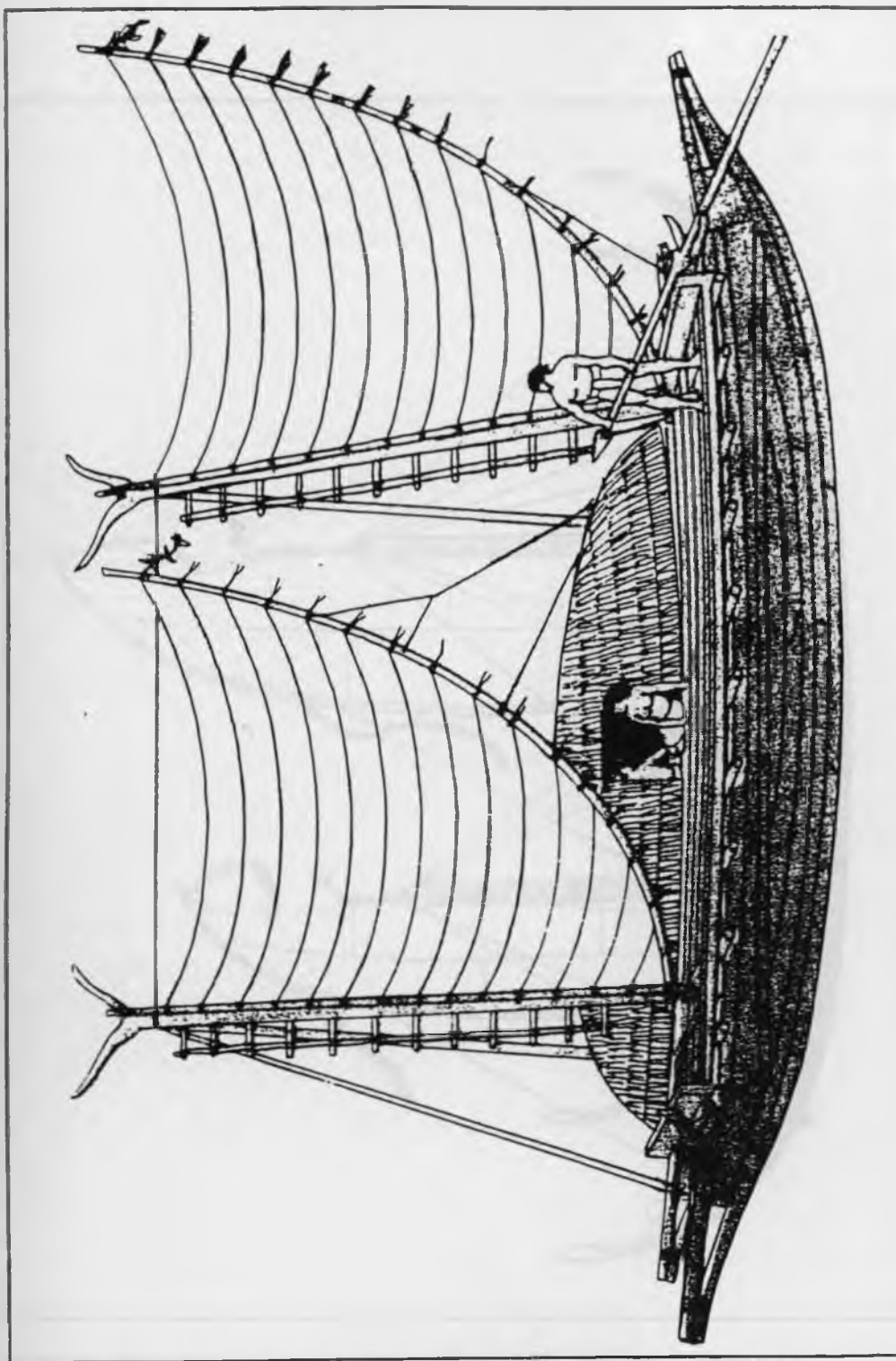


Figure 57: Tuamotuan Pahi (Hunt and Kelly 1984:58).

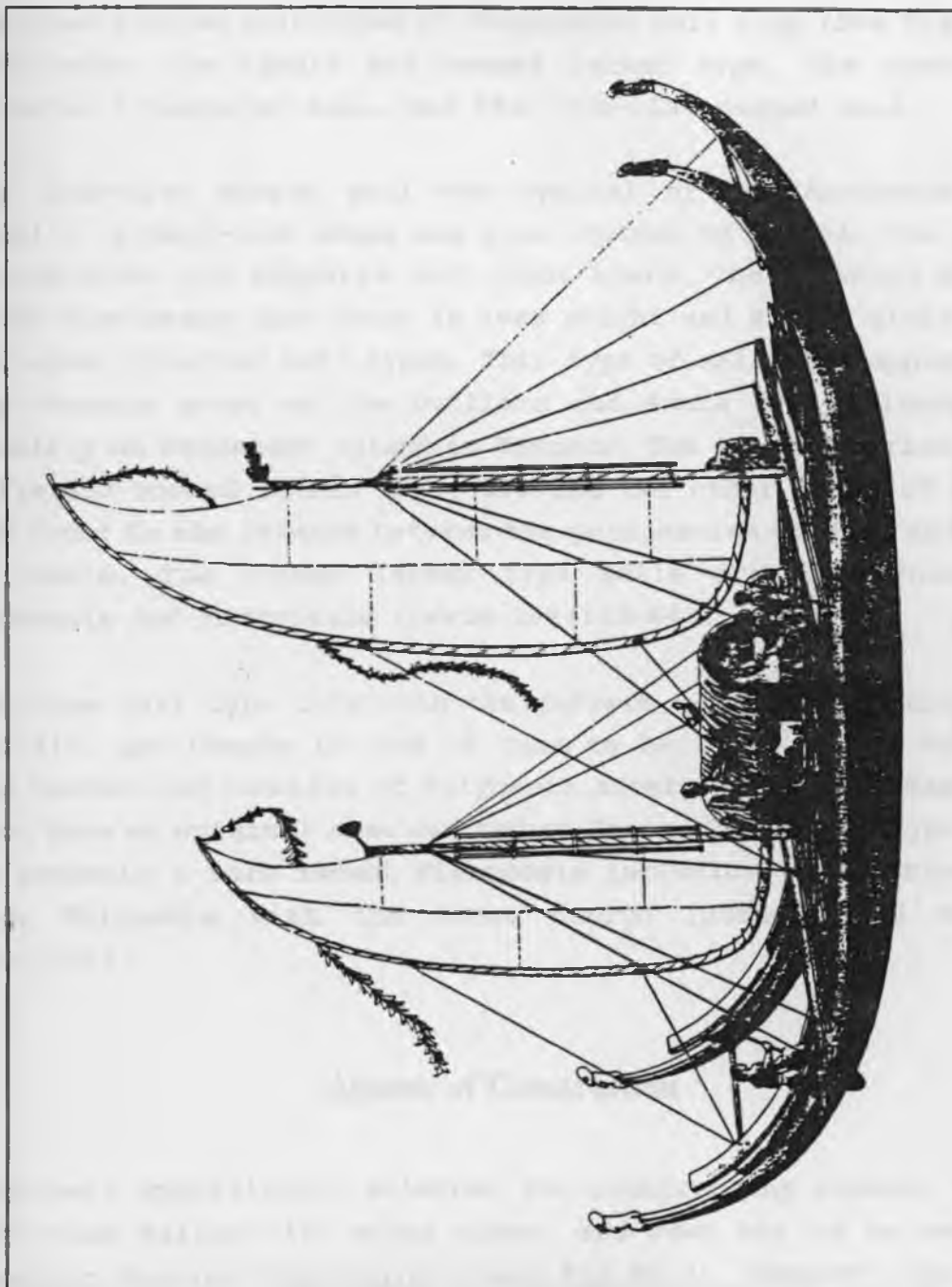


Figure 58: Tahitian Pahi (Hunt and Kelly 1984:43).

Polynesian Sail Rigs

There were three main types of Polynesian sail rigs (See Fig.59). They were: the simple and boomed lateen type, the apex-down inverted triangular sail, and the crab-claw shaped sail.

The crab-claw shaped sail was typical of the Marquesas and Hawai'i. A half-claw shape was also typical of Tahiti. The shape is efficient and supports very light spars. The tapering of the claws also means that there is less weight and stress aloft than for other inverted sail types. This type of sail also appears in the Western areas of the Outliers and Santa Cruz Islands and possibly on Pentacost island in Vanuatu. The inverted triangular sails and boomed lateen types are the two other kinds of sails are found in the islands between the peripheries of West and East Polynesia. The boomed lateen type sails are also found in Indonesia and Micronesia (Lewis 1994:62-64).

The claw sail type fits with the pattern of expansion into the Pacific. One theory is that it came to be found on the eastern and western extremities of Polynesia after a dispersal east and west from an original area centred on Samoa. The lateen type sail is probably a more recent Micronesia intrusion that arrived in West Polynesia with the ndrwa design (Hornell and Haddon 1936:122).

Aspects of Construction

Logs were specifically selected for constructing canoes. These were then felled with stone adzes, and hewn out to be used as keels or dugouts (See Fig.60.1 and Fig.60.2). Greener logs were heated over fires until they split. Using wedges and a heavy mallet, planks were cut off to build up the sides of the hulls, and to be used for decking (See Fig.60.3) (Kane 1984b:38-40).

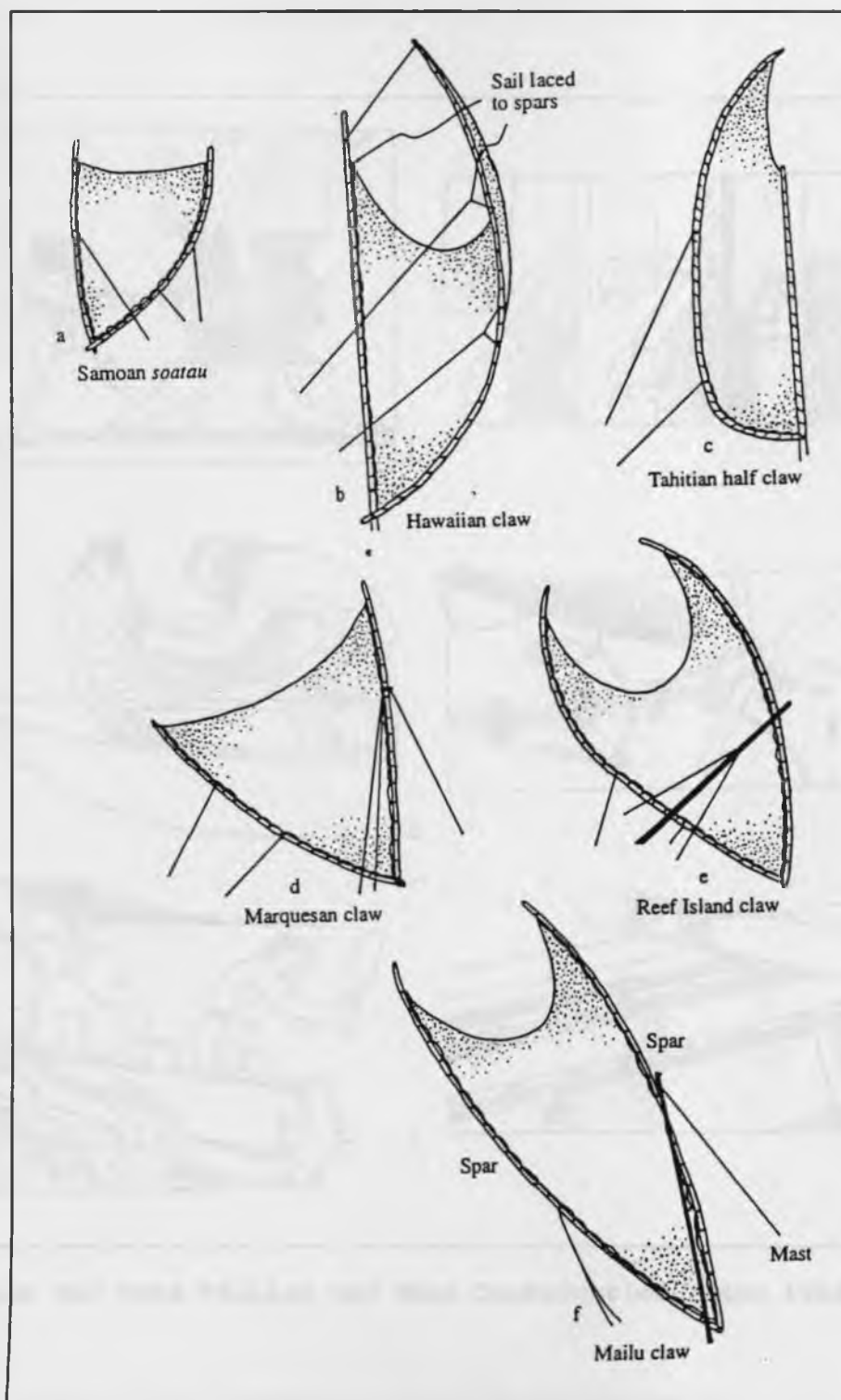


Figure 21: Polynesian Sail Types (Lewis 1994:63).

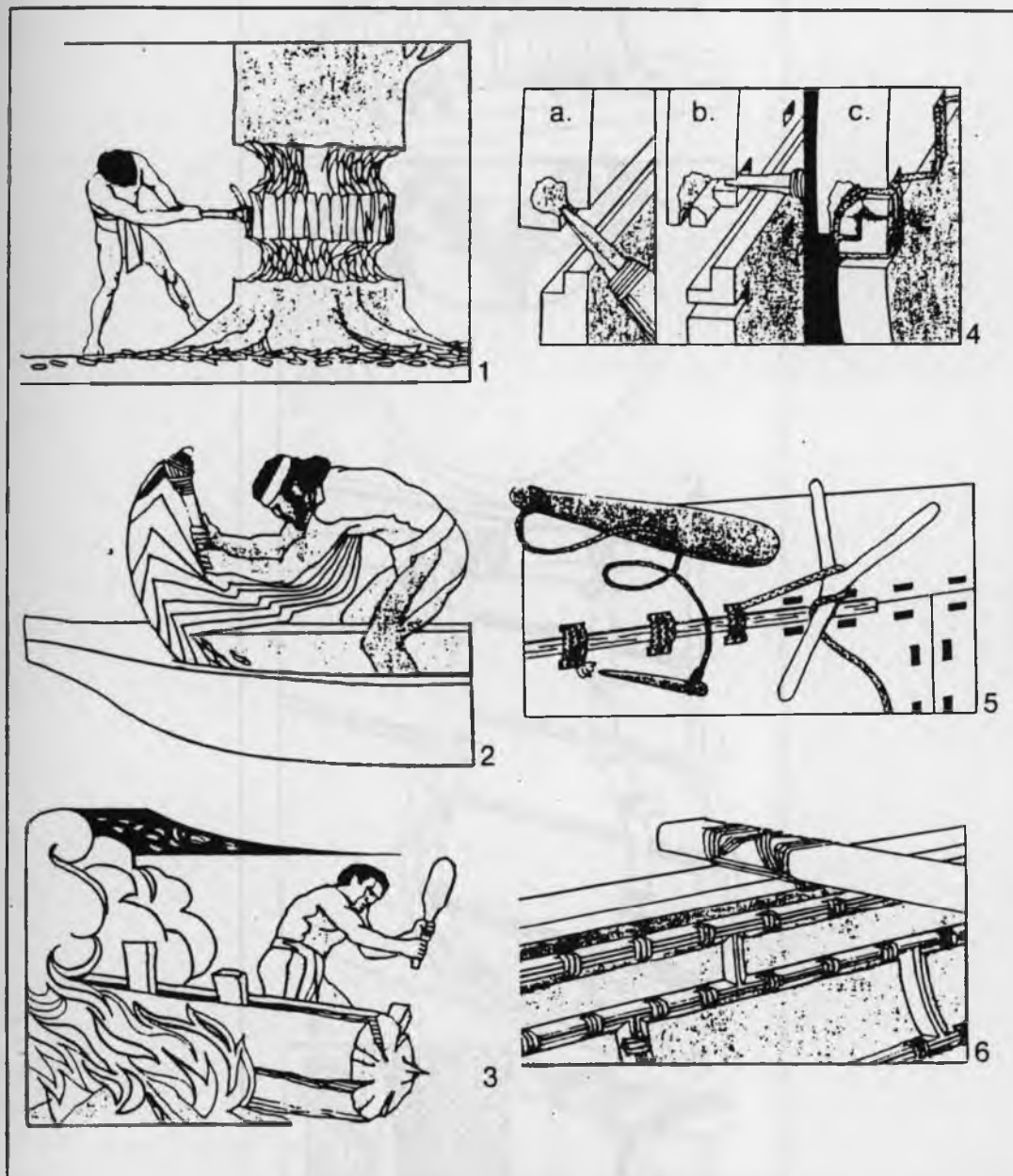


Figure 60: Tree Felling and Waka Construction (Kane 1984b:38-39).

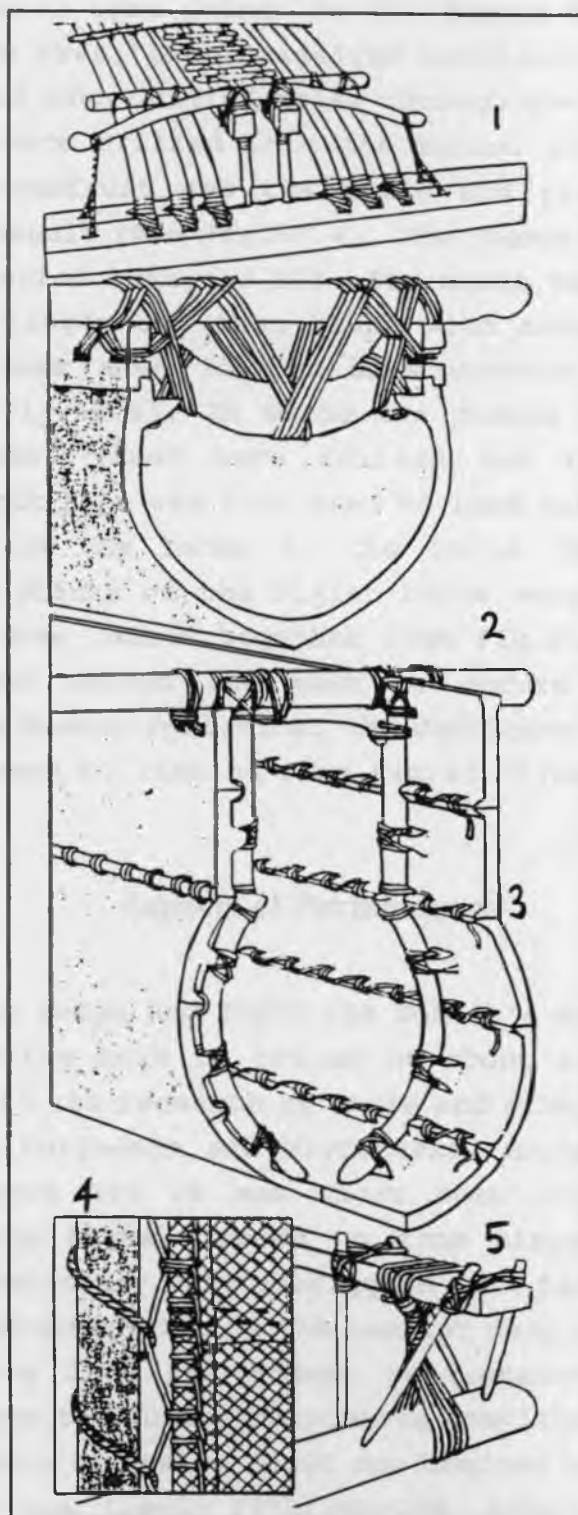


Figure 61: Bracing Outriggers and Lashing Canoes (Kane 1984b:40).

The gunwale planks were joined to the dugout keel by a variety of methods. The Hawai'ians chiselled cavities along the bottom of the plank and then drilled holes through the side and bottom. Similar holes were drilled into the hulls. After caulking the joints with breadfruit sap the hulls and planks were lashed together with sennit (See Fig.60.4). The Tuamotuans shaped their planks to a precise butt-end fit. The seams were battened with coconut frond fibres and then bound with sennit. A spike and stone hammer were used to ram home coconut fibre wads for caulking (See Fig.60.5). In Samoa the planks were shaped with internal flanges. These were drilled and then lashed (See Fig.60.6). Sennit rope was also used to lash outrigger floats to their booms, and the booms to the hulls (See Fig.61.1 and Fig.61.2). The planks of the Fijian ndrua were cut to an exact curvature and then lashed together (See Fig.61.3). Sennit rope was also snaked around the mast to secure the sails (See Fig.61.4). In a Samoan variation, the outrigger float was pegged and then tightened by lashing (See Fig.61.5) (Kane 1984b:38-40).

Aspects of Performance

In Chapters Six, Seven and Eight the *Hokule'a* and *Hawaikinui* are described as being able to cruise at about eight knots. This seems to fit with the research by Lewis and others on traditional canoe types in Polynesia and Micronesia, during the 1960s and 1980s. In Chapter Two it was shown that other vessels were recorded at much higher speeds up from sixteen to more than twenty knots. Certainly many outriggers were fast, however, this would not be characteristic of the heavier deep sea double-hulled canoes. Evidence from the modern renaissance and historical ethnography shows that under reasonable conditions double-hulled canoes are capable of making about one hundred to one hundred and fifty miles per day (Lewis 1972:266-268, 1994:69-71).

The windward ability of the Micronesian, Fijian and Tongan canoes was aided by their 'V' shaped hulls which did much to reduce

leeway. In Chapter Two Bechtol's experiments showed that canoes with 'V' shaped canoes equipped with large steering paddles could sail to within forty-five degrees of the wind. The figure for the *Hokule'a* and *Nalehia* was about fifty-five degrees although they had more 'U' shaped hulls after the Hawai'ian design characteristic of coastal type waka. Steering sweeps were also added to increase leeway resistance (See Fig.62).

In terms of durability, Micronesian evidence shows that the sennit lashings generally lasted for up to two or three years if the canoe was rarely used. However, if the canoe was at sea continuously then the durable life of its lashings was about three months (Lewis 1994:78-79). The experience of the *Hawaikinui* as outlined in Chapter Seven also supports this. When it reached New Zealand the lashings were well worn out. However, despite the constraints, three months seems more than adequate for any long voyage in Polynesia. This evidence is also consistent with the traditions in that arrivals are often cited as waiting several months before departing on especially long voyages probably because their canoes needed refitting (See Chapter Ten).

The waka were capable of carrying large numbers of people and huge loads, although, carrying large loads would seem more likely for voyaging within the archipelagoes. In 1933, one sixty foot outrigger from Pukapuka was recorded carrying three tonnes of copra. Marshall Island and Marquesan outriggers have been recorded with fifty to sixty people on board (Lewis 1994:79). Two storm driven voyages were recorded in 1696 and 1721 with crews of thirty-five and twenty-four respectively (Lewis 1994:79). These numbers seem to approximate the personnel capacity for deep sea voyaging. Larger numbers are generally recorded only for voyages within archipelagoes. For example, Tongan canoes recorded by Cook were seen carrying between eighty and one hundred persons (Beaglehole 1967:939, 1038).

The provisions for long distant voyaging included pre-cooked fermented breadfruit, pounded taro, drinking and eating coconuts

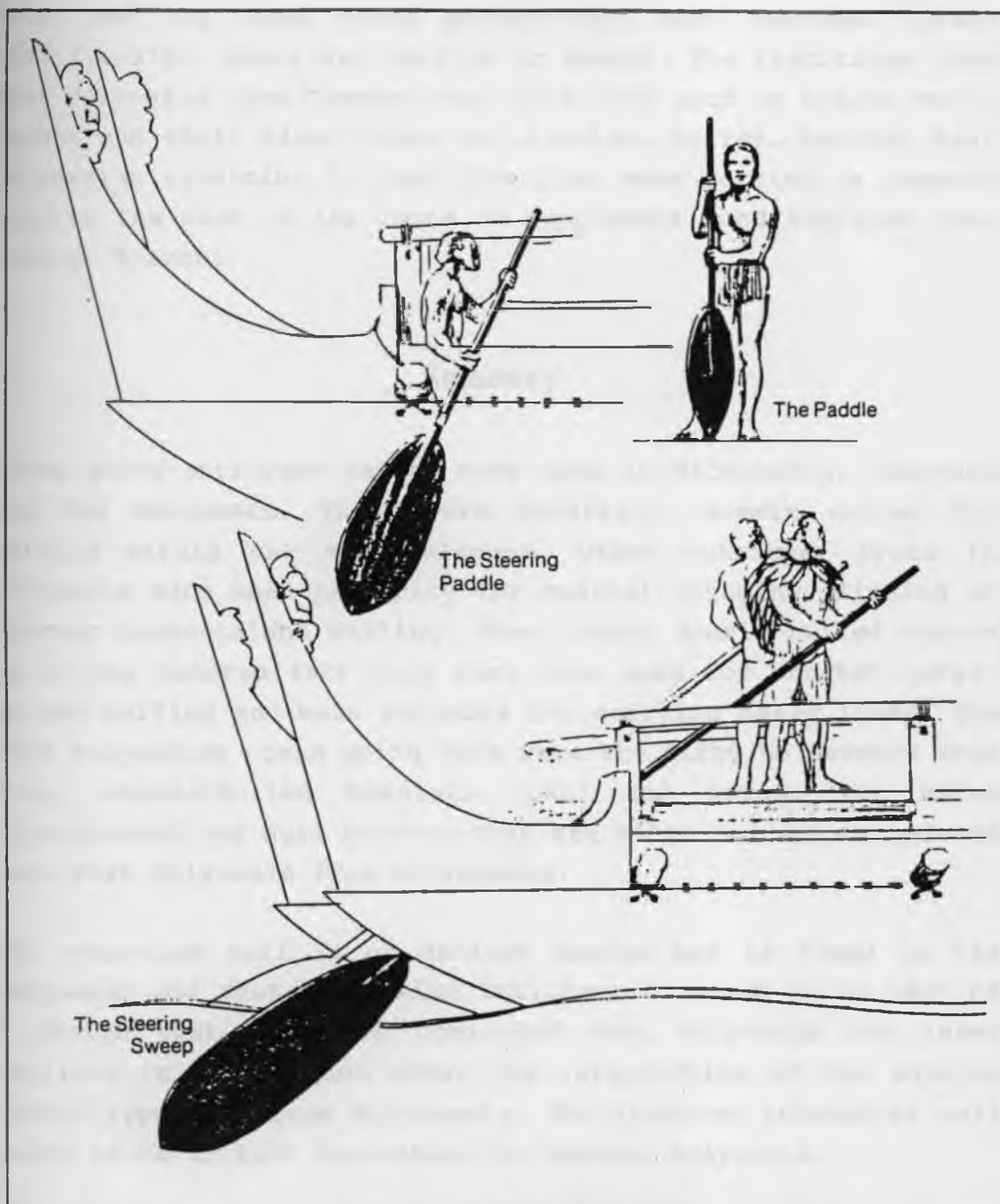


Figure 62: Steering Paddles and Steering Sweeps (Kane 1984b:75).

and baked fish. Fish caught at sea was eaten either raw or cooked over a fire of coconut husks in a bowl. Bananas and taro preserved in oil were also carried. Dried breadfruit chips, other nuts, and the baked sweet potato were also consumed (Lewis 1972:274-275). Water was carried in gourds. The traditions from West Polynesia (See Chapter Ten) cite fish such as bonito being caught and their blood drunk to alleviate thirst. Another East Polynesian tradition is that live fish were carried in baskets tied to the side of the canoe to supplement food supplies (See Chapter Eleven).

Summary

Ocean going outrigger canoes were used in Micronesia, Pukapuka and the Marquesas. These were generally vessels suited for sailing within the archipelagoes. Other outrigger types in Polynesia were used primarily for coastal voyaging, fishing or shorter inter-island sailing. Some larger double-hulled canoes up to one hundred feet long were also used for shorter inter-island sailing and were suitable for carrying heavy loads. The main Polynesian ocean going waka were the fifty to seventy foot long, double-hulled tongiaki, pahi and ndrue. The ndrue incorporated one hull shorter than the other and was introduced into West Polynesia from Micronesia.

The crab-claw sail is of ancient design and is found in the Marquesas and West Polynesian Outliers. It seems to be part of a design that initially dominated West Polynesia but later declined in that region after the introduction of the squarer lateen type sail from Micronesia. The inverted triangular sail seems to be another innovation in Central Polynesia.

'V' shaped hulled canoes were good for sailing to windward. Islands such as Hawai'i and New Zealand adopted more 'U' shaped hulls as the result of the decline in voyaging and the increase in coastal or more localised voyaging.

Double-hulled ocean going canoes were durable and could withstand very bad weather. For example, it is now accepted amongst the modern Polynesian voyaging community that these canoes are superior in performance to single hulled modern vessels during bad weather (See Chapter Eight). There were, however, limits on the lasting ability of their lashings and other materials. This served to restrict how often they could be sailed over long distances without having to be refitted. This is supportive of what the traditions of Hawai'i and Aotearoa say about return voyaging into East Polynesia (See Chapters Eleven and Twelve). Both sets of traditions imply that contact occurred over short periods and then ceased. Although both voyages can be achieved within one month, the wear and tear on vessels would be great.

In a good days sailing a double-hulled canoe could make up to 150 miles per day. For long distance deep-sea voyaging, the usual crew was probably no more than fifteen to thirty-five.

CHAPTER FIFTEEN

THE MOTIVATION FOR VOYAGING

Previous chapters have shown that one of the distinguishing features of Polynesian culture is its extraordinary history of voyaging. For example, the computer simulation conducted by Levison, Ward and Webb (1973:138) showed that the settlement of marginal Polynesia was highly improbable without purposeful, directed navigation. In support of this Irwin (1992:7-8) argued that many of the settlement routes in Polynesia, such as those to New Zealand and other late-settled island groups, were too difficult to have been crossed accidentally. The question remains as to what inspired the ancestors of the Polynesians to undertake these sometimes arduous voyages.

The reasons cited in the literature as the motivating factors for voyaging can be divided into two parts. One concerns the initial exploration and settlement of Polynesia, and the other deals with the reasons for localised or regional voyaging from already settled islands.

Post-Settlement Voyaging

Parsonson (1962:28-32) and Denning (1962:121-122) reviewed the records of early Europeans, and noted that local sailing from already settled islands was undertaken for reasons of fishing, families wishing to visit relatives, and short embarkations to pay homage to rulers. Trade was also a major influence. The

Tongans voyaged to Fiji for sandalwood, and the Tahitians sailed to Taha'a and Borabora for bamboo. The traditions of the Marquesas, Tahiti, Tonga, Rarotonga, Mangareva and the Tuamotus record trade in 'kura' (red parakeet feathers) (See Chapter Ten and Eleven pp.212-280). Others took to the sea as refugees from volcanoes, drought, and famine. Criminals were also set adrift. Warfare was another important factor, involving voyages because of banishment, flight from enemies, or expeditions of conquest. Some secondary voyages of exploration to already inhabited islands were recorded by early European observers. Lewis (1972:277-284) added that voyaging was also undertaken for reasons of adventure. European records attest to navigators in the Fiji-Tongan-Samoan region who were absent for up to two years or more travelling from island to island.

Despite its comprehensiveness, the discussion of the motives for localised voyaging by Parsonson, Denning and Lewis does not address the key issue of first settlement. The crux of this question is to identify in a more precise way, what it was that enkindled the spirit of the ancestral Polynesians to such an extent, that they explored and settled a huge area of the Pacific within a very short period of time.

Voyages of Exploration and Settlement

Succintly there are two kinds of theories with regard to the initial exploration and settlement of island Polynesia. These are divisible into 'push' and 'pull' theories. The more favoured push theories suggest that various internal pressures acted to force marginal groups out, and that this led to the settlement of all Polynesia. Pull theories suggest that the lure of unsettled land attracted mariners to search out, explore and settle unknown islands.

The main push theory suggests that forced departures as a result of island 'over-population' were the primary reason for the

settlement of Polynesia. This is often justified on the basis of archaeological evidence. However, the consideration of this evidence is probably a matter of interpretation. Much of the archaeological evidence serves just as well to explain that an affluent, developed society could afford to send explorers out to search for new lands. Certainly one essential factor necessary for equipping a long distant voyage was the ability to produce a surplus so that the requisite labour and resources could be freed to prepare the canoe. Another key ingredient in this equation is that developed, trading societies, such as those found in West Polynesia, would by definition be prompted to expand their boundaries for political and economic reasons.

Another pool of evidence often used to justify the over-population theory is the many traditional narratives about departures which occurred after strife over resources such as food. Orbell (1985:33) noted that conflict over resources was often mentioned as the driving force in the migrations of the Maori.

However, Irwin (1980:328) wrote that population pressure was insufficient as a reason to explain the primary settlement of Polynesia simply because the outfitting and provisioning of migration canoes was an expensive undertaking. Simply put, most defeated groups would not have the time, energy or resources to organise successful long distance migrations. There are also more expeditious ways of controlling a population. Interestingly, many migratory voyages appeared to have occurred before evidence for population stress appears in the archaeological record.

One of the main reasons promoted by the more romantic pull theories is 'wanderlust' or adventure. However, having a sense of adventure does not fully explain why anyone would want to sail 1,600 miles into the south seas in order to reach New Zealand, or indeed sail the 3,000 miles north from East Polynesia to Hawai'i. It is the writer's view that the 'adventure syndrome' is popularly used in the absence of an adequate analysis. Both

Christopher Columbus and Hernando Cortez possessed a sense of adventure. Both were also in the pursuit of fame, fortune, and riches. Most of all, they sought gold.

Whatever the case may be, it is clear that after the first phase of the initial settlement of Polynesia, there was a gradual decline in the process of long range exploration and settlement, and from about 100AD cultural divergence occurred (McClone, Anderson and Holdaway 1994:138-139). On many island groups the technology for sailing became lost. Irwin (1980:328) draws two conclusions from this. Firstly, the prime purpose of the voyages was to place founding populations, and secondly that information must have been transmitted about successful settlement.

McClone, Anderson and Holdaway (1994:140-144) propose that the desire to explore could have been motivated by the ecological richness of the Pacific islands. They estimated that at the beginning of this millennium the amount of accessible fat and protein per square mile on a Pacific island may have been unequalled anywhere in the world. Unexploited Pacific islands were not just small dots in the vastness of the ocean. Direct evidence exists for the suprabundance of bird and marine resources on and around unexploited islands. The pre-settled Pacific may have had as many as 9,000 species of birds, or more than exists on the entire Earth today. Perhaps as many as 1,000 species of rail may have become extinct since settlement took place. As resource centres, each island was effectively many times larger than the size of its land mass. Each island's bird and marine life utilised thousands of square miles of surrounding ocean. In support of their theory they note that the early phases of settlement on all islands have left rich deposits of bird's bones and that of over-sized marine animals. In a more recent example, during the first convict settlement on Norfolk nearly 170,000 birds were taken during one three month period to feed a population of 1,000.

Usually minimalist theories depict voyagers staggering ashore and

then struggling agriculturally. However, McClone, Anderson and Holdaway (1994:142-144) argue that discovery was more akin to winning a lottery. The reward for the risk and disbursement of a long ocean voyage was an abundance of food and resources which, with care and skill, would have ensured the survival of subsequent generations. The Polynesians with a tradition of exploiting these resources would have been able to put in place preservation techniques ensuring their economic and efficient utilisation.

This theory is supported by Parsonson (1962:61-63) who outlined the 'Sewall-Wright' affect. This concept holds that the degree of genetic drift usually depends on the size of the population. When a community is small the movement is swift. However, when the population is large the rate of change is slow. He noted that the Polynesians were probably nomadic and theorised that the scattered archipelagoes of the Pacific were initially settled by small fast-moving groups and then later by more numerous deliberate colonists. However, once the second wave arrived and became settled this caused a decline in long distance voyaging because labour was increasingly focused on cultivation.

Initial contact or discovery was probably followed by exploration of the resources of the island and surrounding sea. Only after this survey had taken place and the location and resources of the target island were known, might full-scale settlement occur. These planned emigrations might have included the transportation of certain plants and animals for long term colonisation, if required (McClone, Anderson and Holdaway 1994:142-144). Once settlements were established the motives for voyaging probably changed. The aforementioned push, or overpopulation theory is probably more applicable some time after the initial settlements had been established. This would be in accord with the traditions as reviewed in Chapters Ten to Twelve, which frequently mention original inhabitants who were overrun by more recent 'first arrivals'. These stories could refer to a subsequent second wave of settlement occurring before population levels had reached

optimum levels sufficient to repel other arrivals.

Such was the abundance of bird life two thousand years ago that, in direct support of another discussion, McClone, Anderson and Holdaway (1994:143) maintain that migratory birds were likely indicators of far off land. Before the settlement of New Zealand they claim that vast dense streams of birds would have converged on New Zealand from all over Central and Eastern Polynesia. However, with regard to the long-tailed and shinning cuckoo, godwits and golden plover birds, which are usually postulated as the main indicators of the direction of New Zealand, they note that these are small birds which migrate individually. McClone et al suggest that the larger petrels and shearwaters, which coincidentally arrive in New Zealand from mid-October to mid-November, are more likely candidates.¹

The Decline of Voyaging

One of the arguments put forward by Sharp (1956) was that any theory about the existence of Polynesian voyaging must also explain its decline.

Evidence from throughout the Pacific suggests that, after rapid expansion into island regions, and a subsequent period of wide-ranging inter-island communication, voyaging spheres contracted as individual island societies grew and matured. This kind of expansion-contraction cycle is thought to have characterised the Lapita migration trail. Some East Polynesian oral traditions support this concept. The stories concerning Tahiti and Hawai'i in Hawai'ian tradition, and Ra'iatea and Rarotonga in Rarotongan tradition are cases in point (Finney et al 1989:294). Certainly the traditions summarised in Chapters Ten to Twelve indicate that much of the settlement of the islands of Polynesia occurred

¹ This coincides with the ideal time for sailing to New Zealand and with the timing of Kupe's directions (See Chapters Four, Six and Twelve).

between 30GB-1900 to 20GB-1900 after which long distance inter-archipelago voyaging was less frequent. Other commentators such as Smith (1898) state that a golden age of long distance voyaging ended before the close of the fourteenth century.

Climatic variation may also have contributed to the decline in voyaging. Grant (1994:182) suggests that the end of the fourteenth century was marked by a drop in temperature. Cool winds prevailed coupled with a marked decrease in the tropical cyclone regime. This made distant sea travel more difficult.

Another reason for the general decline in voyaging was the arrival of the European. Their craft required less maintenance and relashing. They also provided more shelter and could carry more provisions. In addition to this the missionaries often discouraged long distant voyaging because this caused a decline in the number of potential converts. In similar vein there is one West Polynesian example of the cessation of voyaging by government decree (See Chapter Ten pp.212-233).

Whatever the cause, the traditions contain another clear message. The traditions of Mangareva show that as the number of villages, and tribes evolved after initial settlement there was a corresponding decline in voyaging. Certainly, the early stage of settlement from 26GB-1900 to 20GB-1900 contains much reference to a high incidence of long distance voyaging. It can be assumed that the population was not high because the number of names of sub-tribal groupings and villages is less. At about 15GB-1900 there was a resurgence in voyaging. However, this was accompanied by a corresponding change in the manner by which new arrivals were welcomed. The air was one of caution and the custom of comparing genealogies appears more common place in the narrative. Only related peoples were allowed to land unimpeded. Gradually the double-hulled canoes were used less for voyaging and more in inter-tribal warfare within the archipelago. Deliberate departures decrease except where mention is made of visiting related peoples. Obviously the risk of being killed upon landing

at other islands had increased. At this stage in the traditions the population is also higher, that is, the number of village names and tribal groupings mentioned has increased. Eventually the last of the ocean-going canoes were destroyed shortly before European arrival. By this time most outward departures were forced because of defeat in war. Many of these were attempted on rafts rather than ocean-going canoes (See Chapter Eleven). This would not be an ideal way to settle the Pacific.

This view is supported by the traditions of Rarotonga which, after settlement by Tangi'ia and Karika, state that voyaging was largely concerned with maintaining contact within the archipelago. The post-settlement traditions of the Northern Cooks, Rarotonga, Uvea and the Tuamotus also describe the common practice of killing new arrivals. This occurs later rather than earlier in their traditions (See Chapters Ten and Eleven). Such a pattern, which seems characteristic of the traditions from East Polynesia and much of West Polynesia, would also cause a decline in extended trading networks or certainly in the frequency with which long-distance voyages occurred.

There seems to be an inverse relationship in that when populations were lower there was more voyaging for migration, and other than forced voyages, less when populations were higher.

Summary

The primary voyages of settlement were motivated by exploration for prosperity, resource exploitation and settlement. These likely occurred as extensions of already existing trade networks. In this sense the voyages had as much to do with economics as they did with a sense of adventure.

After the initial settlement of Polynesia the process of decline began almost immediately. This was also inevitable because once all the islands were populated, and once those populations had

increased to a certain threshold, the opportunity for new pristine discovery was gone. Long distance voyaging also declined because of the desire to retain possession of islands and their resources, and because of the requisite need to repel unwelcome arrivals. Secondary voyaging continued to occur for more localised reasons of trade, fishing and religious or political functions. The primary centres for political-religious voyaging were between Fiji, Tonga and Samoa in West Polynesia, and between the Society and Tuamotuan islands in East Polynesia. Some voyaging continued to take place as the result of defeat in war, famine and drought. However the classic phase of deep-sea voyaging to unknown destinations, was probably already in decline some time after the settlement of New Zealand and the Chathams.

CONCLUSION

POLYNESIAN ORIGINS, MIGRATIONS, AND NAVIGATION

This thesis has presented a broad, detailed synthesis of the literature concerning the origins, migrations, and navigational ability of the Polynesians. Five main fields of study were investigated, namely, archaeology, the records of early European observers in the Pacific, the renaissance of modern voyaging, Polynesian oral tradition, and the principles, techniques, and technology of the Polynesian Navigation System, coupled with an analysis of the motivating factors that inspired the primary settlement of Polynesia, and continued to stimulate post-settlement voyaging.

The main feature of the synopsis is the striking convergence of the evidence between different fields of study. Part of the approach taken here has been to grant equal weight to material from the oral traditions. However, it is acknowledged that more work is required to add further integrity to the consideration and analysis of Polynesian oral tradition as evidence. Despite that, it is felt that the approach is new, not only because of the extent of the survey but because of the very compelling nature of the consistency of the evidence presented. Perhaps the work undertaken here will serve as a precursor for others interested in the analysis of oral tradition.

The Genesis of the Polynesians

In conclusion, the archaeological, linguistic, ethnobotanical, ethnozoological, and biological evidence from anthropology shows that the very earliest Polynesians were derived from initial populations that moved into Near Oceania, from Asia, between 50,000 to 30,000 years ago. These colonists reached the end of the Solomon Islands where further migration into Far Oceania was halted for another 25,000 years because of an increase in the distance between islands from sixty to 110 miles, up to 350 miles (See Chapter One pp.25-28).

Despite the halt, the close proximity of the islands in this region, and the favourable winds and currents acted as a fulcrum for the further development of navigational technique and technology. This process is evidenced archaeologically by the long distance trade in stone artifacts by sea up to 20,000 years ago in far reaches of Near Oceania. This was further aided by the gradual increase in sea levels from about the end of the Pleistocene epoch (See Chapter Thirteen pp.284-286).

In technological terms there was an evolution from simple rafts to dugouts. Outriggers and steering paddles were adopted for stability. Hull shapes became specialised with the V shape being preferred for deep-sea voyaging. Eventually this culminated with the emergence of the double-hulled ocean-going waka. In terms of technique, specific search and return strategies were adopted. These involved sailing across the predominant trades and making safe returns before them. In a parallel development, astronomical guidance systems were also formulated (See Chapter Thirteen pp.285-286). Once these skills had been mastered the pre-Polynesian ancestors were equipped for further expansion into the Pacific.

From about 6,000BP to 3,600BP onwards a distinctive maritime, Austronesian speaking society called Lapita, emerged from within

the region of the Bismarck Archipelago, including New Britain and New Ireland. This culture represented a mesh of influences from Southeast Asia and Near Oceania (See Chapter One pp.30-34). By 2,000 to 1,000 years ago these peoples had colonised the Solomon and Santa Cruz Islands, Vanuatu, New Caledonia and the Loyalty Islands. By 1300BC to 1000BC they had also settled Tonga and Samoa, more than 2,400 miles east from the Bismarcks. The descendants of this population were the ancestors of the Polynesians (See Chapter One pp.34-35).

A second pause is argued after the settlement of the Santa Cruz Islands, Vanuatu and New Caledonia, and before the settlement of Polynesia. However, any gap in the dates is only of a few hundred years at most and probably reflects a paucity in the data. By the time voyagers had reached the Andesite Line they were already very capable mariners. There seems to be little reason why they would not continue venturing towards the east. The review of Pacific weather patterns in Chapter Three (pp.76-83), and the evidence of early European explorers in the Pacific Basin (See Chapter Two pp.52-53), and that from the traditions of West Polynesia and the Outliers (See Chapter Ten pp.212-231), also shows quite clearly, that latter day navigators were capable of crossing the gap between Melanesia and West Polynesia. There seems little reason why their intrepid ancestors might not have done the same. Furthermore, this is what would be expected given the strong motivation to seek out new islands (See Chapter Fifteen (pp.333-341). It is likely that the process of settlement was continuous. However, if movement was rapid, and likely it was, then the initial populations may have been quite small over an extended area. This might also make them archaeologically difficult to detect.

The route that the pre-Polynesian ancestors took has also been the subject of debate. Some suggest they moved directly east through Melanesia and others via Micronesia. Some Melanesian social practices such as brother and sister avoidance and the authority of the sister's son are present. However, these may be

late influences from Fiji. The wooden neck rest and distinctive kava bowls are also Fijian rather than Melanesian. One element against migration from Melanesia is the absence of the bow and arrow in Polynesia. A Micronesian path is backed by a correspondence in mythological elements. Tongan mythology has more in common with Micronesia than Fiji. The sling is also a weapon known in both Micronesia and Polynesia (Hiroa 1945:12-13). There is also a high correspondence between the sail rigs, hull shape, and canoe types of Micronesia and Polynesia (See Chapter Fourteen pp.316-332). The Lapita evidence suggests a route east from the Bismarck, Solomon, Santa Cruz, and Vanuatu archipelagoes (See Chapter One pp.30-34).

During the next phase of settlement and migration, all of East Polynesia was settled from West Polynesia. The orthodox scenario is that a third pause occurred after the arrival in West Polynesia and that East Polynesia was settled between 300AD and 1000AD. However, many of the arguments about the pause between Melanesia and West Polynesia also apply. At the present time a paucity in the archaeological data, and other problems, may preclude the finding of an earlier date. The discussion of weather patterns in Chapter Three (pp.82-85) certainly shows that seasonal westerlies are sufficient to take any deliberately sailed canoe into East Polynesia. The voyage of the *Hokule'a* from Samoa to Rarotonga and Tahiti also proves this (See Chapter Six pp.145-149). The summaries of the traditions from the Northern Cooks and Samoa also describe frequent contact with West Polynesia. This northern voyaging route considerably reduces the generally perceived 1,000 mile gap between West and East Polynesia to 390 miles. It is worth noting that both Pukapuka, in the Northern Cooks, and the Marquesas are also the only East Polynesian islands which possessed large ocean-going outriggers. These canoes are characteristic of those found latterly in Micronesia, Fiji and other West Polynesian islands. These three groupings were certainly in contact prior to European arrival (See Chapter Fourteen pp.316-332). The authenticity of another possible route between the Southern Cooks and Niue, as mentioned

in the traditions of Aitutaki, is less likely (See Chapter Eleven pp.234-240, 244-246). Nonetheless, earlier settlement dates for East Polynesia are probable.

The final act in the settlement of Polynesia was the migration to New Zealand and the Chathams. Debate continues as to when this occurred. The general opinion is that it happened somewhere between 800AD to 1000AD. Some argue for an earlier date from between 0AD to 500AD, and others claim later dates up to about 1200AD. Linguistic evidence supports an East Polynesian origin, as do congruences in the archaeological record. Archaeological finds on the Kermadecs and on Norfolk Island, dating to within the last 600 years support the view that return voyages were being made at some stage. These records also correspond with archaeological records of an inter-island contact zone within the Cook Islands. This suggests that the two areas may have been in contact (See Chapter One pp.42-43). In support of this view, the New Zealand traditions from Northland, the Bay of Plenty and the East Coast show a high correspondence of personal names, place names and genealogies with those from the Cook and Society Islands (See Chapter Twelve 267-272). Interestingly, there is also a high correlation between the personal and place names associated with some New Zealand West Coast traditions and those from parts of West Polynesia and the Outliers, suggesting perhaps, that some early arrivals may have come from there (See Chapter Twelve p.279).

The East-West Question

As already stated, the antecedents of the Polynesians came from the west of the Pacific basin rather than the Americas. Linguistically the Polynesian languages are a subgroup of the Austronesian family of languages within which they share characteristics in grammar, vowel sounds, consonant variation, lexicostatistics and glottochronology. No similar correlation exists with the indigenous languages of the Americas.

Ethnozoological evidence including the dog, pig and chicken, and ethnobotanical evidence such as the presence of the coconut, taro, yam, gourd, banana, and arrowroot also indicates a western origin. This is further supported by biological anthropology evidence including the genetic analysis of the Polynesian white cell HLA, haemoglobin and mitochondrial DNA (See Chapter One p.25).

At least some contact with the Americas is evidenced by the presence of the kumara in the Pacific, and to a lesser extent cotton. Additionally, the archaeological evidence reviewed by Finney (1991) indicates that artifacts from the continental coastlines of Australia, North and South America are possibly associated with Polynesia (See Chapter Three pp.87-88). However, it is unlikely that any extensive continuing contact existed between Polynesia and the Americas over an extended period of time. Meteorologically all the voyaging routes from Polynesia to the Americas are hazardous (Chapter Three pp.87-88). Neither does the western coast of the American continents afford any convenient place for the evolution of a system of navigation adequate enough to have settled Polynesia. Certainly, nineteenth century sailing vessels exploited the winds of the 'roaring forties', albeit over rougher seas, to reach South America. However, the experience of the *Hawaikinui* (See Chapter Seven pp.159-174), and the summary in Chapter Fourteen (p.329) stressed the limits of the endurance of Polynesian canoes in that kind of environment for extended periods of time. The experience of the *Tahitinui* is another case in point. It is also worth noting that despite the luxury of their modern wet weather gear the crew of *Te Aurere* prematurely decided to head north during their voyage to Rarotonga in 1992, partly because of the increasing cold they encountered in the higher latitudes. Significantly, this voyage was undertaken during the spring which is not as cold as it gets (See Chapter Eight p.179).

Three scenarios exist for contact with the Americas. Firstly some Americans were blown into the Pacific and made landfall, and

brought the kumara with them. Secondly some Americans were blown into the Pacific, made landfall, and after informing Polynesians of the whereabouts of the Americas, an expedition was launched which later returned with the kumara. A third scenario is that some Polynesians deduced the whereabouts of the Americas after observing the migrations of certain birds and then launched an expedition of exploration themselves. The latter two are the likely scenario's. Finney (1991) favours option two and Irwin (1992) favours option three.

The key point is that however the initial contact came about overall contact was minimal rather than substantial. Any idea that the Polynesians were from the east, or that they maintained contact with the American continents over long periods of time is without foundation in the evidence.

Polynesian Navigational Ability

Scholars of Polynesian navigation have reached a consensus that the Polynesians had both the technology and navigational skill to make long distance voyages. The archaeological record, as already discussed, clearly suggests that once peoples had settled West Polynesia they were already competent navigators. The records of early Europeans further testify to the Polynesian ability to navigate astronomically, interpret the weather, and exploit seasonal westerlies to make good easterly progress. Several long voyages including some beyond 1,000 miles were recorded (See Chapter Two pp.51-55, 65-71).

The analysis of the predominant weather patterns in the Pacific also suggests that the ancestors of the Polynesians were capable navigators because the entire pattern of settlement runs west to east against the prevailing currents and winds (See Chapter Three pp.76-88). In addition to this, the Polynesians could not have reached every island in East Polynesia and its periphery between 300AD and 1000AD, without the ability to plan, strategise and

execute deliberate voyages of exploration. In another example of consistency in the evidence, Heyen (1962) noted that the Polynesian traditions favoured migratory routes that took northern and southern tracks across winds rather than before them. A sailing pattern such as this indicates that specific sailing strategies were adopted. This concept is further supported by Irwin's (1989, 1992) theory of 'against across and down the wind', that the Pacific was settled by planned deliberate voyages of exploration (See Chapter Two p.67, and Chapter Thirteen pp.249-286). This in turn complements the archaeological evidence which suggests an extended period of learning and development within Near Oceania. Part of the culmination of this period of learning was the adoption of safe sailing strategies.

The modern voyages as discussed in Chapters Four to Eight (pp.90-188), confirm the validity of traditional methods of voyaging. They are also in accord with the overwhelming testimony from the traditions as summarised in Chapters Ten to Twelve (pp.211-279).

That the Polynesians possessed the appropriate technology is shown by Bechtol's (1962) research. His tests proved that 'V' shaped hulls, and steering paddles, were good for windward sailing because they resisted lateral displacement. Doran (1976) noted that the hull shapes and length to beam ratios of Polynesian canoes represented a high level of technology suitable for long distance voyaging (See Chapter Two pp.67-68, 72). Finney (1991) noted that the 'U' shaped hull, and other features of the Hawai'ian canoes was a local innovation specifically tailored to meet the requirements of sailing within the Hawai'ian archipelago (See Chapter Five p.101). These themes of design and construction are reiterated in the summaries contained in Chapter Thirteen (pp.282-286) and in Chapter Fourteen (pp.316-332) which traces the development of Polynesian blue-water craft from their beginnings as humble rafts and dugouts 50,000 years ago to the sophisticated Polynesian double-hulled ocean-going canoe.

Denning (1962) summarised the Polynesian system of navigation based on the skilled observation of weather and swell patterns, combined with an ability to navigate accurately according to the stars. Various natural signs such as the flight path of birds were used to detect land. The key tenet of the system rested on the ability to deduce the presence of land by collating, and interpreting data from a number of observable phenomena (See Chapter Two pp.69-70).

Chapter Thirteen (pp.282-315) summarised the Polynesian Navigation System on the basis of the evidence aggregated during the modern revival. This information is consistent with that recorded by early Europeans in the Pacific. Essentially Polynesian navigation had three components. The first involved the initial determination of the location of land, followed by the formulation of an initial reference track, and the memorisation of the celestial course. The second component, incorporated the maintaining of direction at sea, the calculation of position, and the estimation of distance voyaged. The third was to make safe landfall according to the observation of a multitude of natural indicators.

The general consensus is that for early Polynesians migratory birds indicated the presence of far off land (See Chapter Two pp.69-70 and Chapter Fifteen pp.333-340). Voyages were then planned, and an initial reference course mapped, and star paths memorised. At sea, position was calculated primarily according to astronomical observation, and secondly according swell patterns and other indices. A system of dead reckoning, which took into account set and drift, was used to estimate distance voyaged on a daily basis. These calculations were then compared with the initial reference course line. Daily errors were found to even out (See Chapter Six p.124-125 and Chapter Thirteen pp.281-314).

The third element in the Polynesian Navigation System was making landfall. This was achieved on the basis of two axioms. The first

is that the accurate observation of certain natural indices will reliably indicate land. The second is that those naturally occurring phenomena surrounding an island will project the island as an expanded target by an average thirty miles off its shoreline. Island groups also become expanded as island screens. For example Rarotonga is, because of its distinctive cloud cover and land based birds, detectable fifty miles out to sea. The Southern Cooks Islands however, present a detectable screen 300 miles long by 200 miles wide. The main indicator of land based birds departing or returning from fishing at sea. Other factors such as distinctive cloud cover, refracted and reflected swell patterns also assist (See Chapter Thirteen pp.305-313).

Drift Voyaging

There is no doubt that drift voyages occurred and these are amply recorded. At least two are recorded over distances of 3,000 miles. However, contrary to Sharp's (1956) thesis, accidental voyages were not how Polynesia was settled. This is clearly shown by the fact that most drift voyages in Polynesia occur east to west which is entirely opposite to the direction of Polynesian migration (See Chapter Two pp.54-55).

The traditions also support this view. Traditional lore from the Polynesian Outliers and West Polynesia record many accidental arrivals. However, they also record the departure of many of those arrivals under conditions which support the view that under favourable weather conditions they were more than able to make deliberate returns from whence they had come (See Chapter Ten pp.212-233). Several drift voyagers making returns are also reported by Europeans, and include a deliberate return of 1,000 miles from New Ireland to Ocean Island (See Chapter Two p.65).

Although both deliberate and drift voyages accounted for the settlement of Polynesia, the weight of the evidence is that accidental voyaging was less significant than the former. For

example, a computer simulation by Levison, Ward and Webb (1973) suggested that many voyages, including the migration from West to East Polynesia, the settlement of New Zealand, Hawai'i, Easter Island, and the settlement of many of the Outliers could not have occurred by accidental voyaging (See Chapter Two p.71).

Spheres of Regional Contact

The migration into West Polynesia represented an extension of a trading network centred on the Lapita homeland in Near Oceania. The further extension of trading networks in West Polynesia led to settlement of East Polynesia. At different times the voyaging boundaries of East Polynesian spheres of contact or homelands were extended, and this led to the settlement of Easter Island, Hawai'i and New Zealand.

The first trade network began at least 20,000BP in the Bismarck Archipelago. The extension of this network into the Solomons, Santa Cruz, Vanuatu and New Caledonia paralleled the settlement of those regions (See Chapter One pp.27-33). Once West Polynesia had been settled then new trade networks were formed (See Chapter One p.40). This is consistent with the traditions of West Polynesia which show a central region of contact centred on Fiji, Tonga and Samoa. This central region was joined to other overlapping zones of contact on its periphery. The extended northern boundary of the overall contact zones extends 1,000 miles from the Northern Cooks and Samoa, and Tokelau in the east to Tokelau, Tuvalu, Kiribati into Tungaru in the north. The Tungaru-Tuvalu connection represents one of the main links with Micronesia. This connection is consistent with trends in waka design and construction. The western fringe extends another 1,000 miles at least into the Polynesian Outliers (See Chapter Ten pp.231-232).

In the traditions the majority of references to voyaging are about localised voyages within archipelagoes. The second most

frequent mention is of voyages between archipelagoes such as between Tuvalu and Tonga, Fiji and Tonga, or the Societies and the Tuamotus (See Chapters Ten to Eleven pp.212-262). This is consistent with Sharp's (1956:5-6) evidence in citing the records of early Europeans who observed that the majority of Polynesians usually only sailed within their islands groups up to distances of between 200 to 300 miles (See Chapter Two p.60). Although he was wrong in arguing that this proved a lack of navigational ability his description of the extent of close quarter contact was accurate enough. What he failed to appreciate was that his claims were merely reporting the most common first level of sailing based on inter-island communication and trade. In this sense it is consistent with what would be expected on a regular basis.

Beyond that, longer voyages were undertaken. Records kept by early Europeans show that the Tongans ranged over Fiji, Samoa, Uvea, Niue, Tokelau, Tuvalu, Rotuma, Tikopia, Sikaiana, the Gilbert Banks and Duff islands. Long trips were made with intermediate stops not because of a lack in ability but because this was easier, safer and convenient for reprovisioning and refitting canoes. One such trip of 1,270 miles with only one stop from Sikaiana to Fiji is cited by Parsonson (1962)(See Chapter Two p.65).

After initial settlement, and when these networks were first established, they were then extended throughout the region. Once these networks had reached a certain level they then were again extended as part of exploratory voyages which took new arrivals into East Polynesia. The process was then repeated. The archaeological record also describes 'homeland' areas of contact with East Polynesia. An assemblage of artifacts found throughout East Polynesia except Hawai'i and Easter Island dates to 1000AD to 1200AD. These artifacts including stone, and shaped whale bone articles appear throughout East Polynesia (See Chapter One p.39-40). In further support of the traditions dates from the Southern Cooks from between 800AD and 1400AD indicate contact with the

Northern Cooks and Austral Islands. Possible links with Tonga and Melanesia may also exist (See Chapter One pp.40-41).

Summary

Ka tipu ake ratou i Hawaiki-pamamao, i whakakake ratou i Hawaikiraro ki Hawaikirunga, i whai ratou ki Tama-nui-i-te-ra nana i ao ake ki runga. Ka whakaheke etahi ki raro, ki tua o Te Tihi-o-Manono. Ka whakakake tonu ki Te Tokerau ki Te Tonga tae noa ki konei. Ko nga tohu ko Te Waka-o-Tamarereti, Te Waka-o-Uruao, Te Matau-a-Maui. Ko aiane i ka noho ai nga kura i runga i Te Paepae-o-Rehua, i Te Paepae-o-Kuku me Matariki, i Te Paepae-o-Mahutonga.

Nearly 3,500 years ago the ancestors of the Polynesians came from the west, where the sun sets. Their descendants, the Polynesians, systematically settled all the islands of Polynesia, firstly eastward toward the rising sun, and then to the north and south.

In conclusion, it is clear from the evidence of their maritime technology and navigational techniques, that the Polynesians were pre-eminent among all mariners of the first millennium. Their deeds upon the sea were not surpassed, until the middle of the second millennium when Christopher Columbus inadvertently bumped into the Americas while on his way to Cathay.

BIBLIOGRAPHY

BIBLIOGRAPHY

GENERAL REFERENCES

BRUNSON, MARSHALL. 1961. *Geography of the United States*. 2nd ed. New York: McGraw-Hill.

BRUNSON, MARSHALL. 1961. *Geography of the United States*. 2nd ed. New York: McGraw-Hill.

BRUNSON, MARSHALL. 1961. *Geography of the United States*. 2nd ed. New York: McGraw-Hill. *Geography of the United States*. 2nd ed. New York: McGraw-Hill. *Geography of the United States*. 2nd ed. New York: McGraw-Hill.

BRUNSON, MARSHALL. 1961. *Geography of the United States*. 2nd ed. New York: McGraw-Hill.

BRUNSON, MARSHALL. 1961. *Geography of the United States*. 2nd ed. New York: McGraw-Hill.

BRUNSON, MARSHALL. 1961. *Geography of the United States*. 2nd ed. New York: McGraw-Hill.

BRUNSON, MARSHALL. 1961. *Geography of the United States*. 2nd ed. New York: McGraw-Hill.

BRUNSON, MARSHALL. 1961. *Geography of the United States*. 2nd ed. New York: McGraw-Hill.

BRUNSON, MARSHALL. 1961. *Geography of the United States*. 2nd ed. New York: McGraw-Hill.

BRUNSON, MARSHALL. 1961. *Geography of the United States*. 2nd ed. New York: McGraw-Hill.

BIBLIOGRAPHY

Oral Informants

Bersich, Martin. 1995. Crewman on *Namsang* 1992. Crewman on *Te Aurere* 1992 to 1995.

Conrad, Stanley. 1995. Captain of *Te Aurere* 1992 to 1995.

Puhipi, Hekenukumaingaiwi. 1993. Tohunga Tarai Waka and instigator of *Te Aurere* project, on Waka Huia, *The Navigators*, August 2nd. Television New Zealand.

1995. Tohunga Tarai Waka and instigator of *Te Aurere* project.

Snowden, Sam. 1993. Kaumatua, on Waka Huia, *The Navigators*, August 2nd. Television New Zealand.

Waka Huia, 1993. The Navigators, August 8th. Auckland. Television New Zealand.

1993b. The Navigators, September 5th. Auckland. Television New Zealand.

Whakataka-Brightwell, Matahi. 1994. Carver, Builder and Navigator on *Hawaikinui* in 1986.

Wilson, Charlie. 1995. Crewman on *Te Aurere* 1992 to 1995.

Winiata, Pakake. 1995. Crewman on *Te Aurere* 1992.

Unpublished Sources

Biggs, B. 1969. The Genealogical Records of the Maori.

A paper presented to the World Conference
on Records and Genealogy.

(ed). 1994. Tainui by Pei Te Hurinui Jones.
Unpublished manuscript.

Finney, B. (ed). 1991. Voyage of Rediscovery. Unpublished
manuscript.

Harrison, P. 1992. Tradition. Nga Waka. Nga Iwi. Paper and
lecture presented to Stage 3 Whakairo class.
Department of Maori Studies. Auckland
University.

Walker, R. 1993. A Paradigm of the Maori View of Reality.
Unpublished paper. Auckland University.

1994. Lecture on Polynesian Navigation to
Stage 1 class. Department of Maori Studies.
Auckland University.

Whakataka-Brightwell, Matahi. 1994. Waka: The Beginnings.
Unpublished manuscript.

Published Sources

Adkin, L. 1960. An Adequate Nomenclature for the New Zealand Area. Journal of the Polynesian Society, 69:228-238.

Aitken, R. 1930. Ethnology of Tubuai. Honolulu. Bishop Museum Bulletin 70.

Alkire, W.H. 1965. Lamotrek Atoll and Inter-island Socio-economic Ties. Studies in Anthropology no:5. North American Anthropological Society.

Akerblom, K. 1968. Astronomy and Navigation in Polynesia and Micronesia. Stockholm. The Ethnographic Museum.

Anderson, A. 1989. Prodigious Birds: Moa and Moa-Hunting in Prehistoric New Zealand. Cambridge. Cambridge University Press.

Audran, Rev. P.H. 1918, 1919. Traditions of and notes on the Paumotu (or Tuamotu) Islands. Journal of the Polynesian Society, 27:26-35, 90-92, 132-136; 28:31-38, 232-239.

Babayan, C., B. Finney, B. Kilonsky, & N. Thompson, 1987. Voyage to Aotearoa. Journal of the Polynesian Society, 96:161-200.

Banapa. 1920. An Old Tradition From Rakahanga Island. Journal of the Polynesian Society 29:88-90.

Barrere, D. 1967. Revisions and Adulterations in Polynesian Creation Myths, in G. Highland et al. (eds), Polynesian Culture History, Honolulu. Bishop

Museum Special Publication 56, pp.103-119.

Beaglehole, E. & P. 1938. Ethnology of Pukapuka. Honolulu. Bishop Museum Bulletin 150.

Beaglehole, J.C. (ed). 1962. The Endeavours Journals of Joseph Banks 1768-1771. Vol. 1. Sydney. Angus and Robertson.

(ed). 1967. The Journals of Captain James Cook, Third Voyage 1776-1780. Cambridge. Cambridge University Press.

Beattie, H. 1915. Traditions and Legends. Collected From The Natives of Murihiku (Southland New Zealand). Journal of The Polynesian Society, 24:98-112.

Bechtol, C. 1962. Sailing Characteristics of Oceanic Canoes, in J. Golson (ed), Polynesian Navigation. A Symposium on Andrew Sharp's Theory of Accidental Voyages. Wellington. The Polynesian Society, pp.98-101.

Beckwith, M. 1932. Kepelino's Traditions of Hawaii. Honolulu. Bishop Museum Bulletin 95.

1970. Hawaiian Mythology. Honolulu. University of Hawaii Press.

Bellwood, P.S. 1978. Man's Conquest of the Pacific. Auckland. Collins.

1985. Prehistory of the Indo-Malaysian Archipelago. Sydney. Academic Press.

Best, E. 1901. Te Whanga-Nui-A-Tara. Wellington in Pre-Pakeha Days. Journal of the Polynesian Society, 10:107-165.

1922. The Astronomical Knowledge of The Maori. Wellington. Dominion Museum Monograph no 3.

1923. The Origin of the Maori. The Hidden Homeland of the Maori and its Probable Location. Journal of the Polynesian Society, 32:10-20.

1924. The Maori As He Was. Wellington. The Polynesian Society.

1924b. Maori Religion and Mythology: Part I. Wellington. Government Printer.

1925. Tuhoe. Vols:1-2. Wellington. The Polynesian Society.

1925b. The Maori Canoe. Wellington. Government Printer.

1982. Maori Religion and Mythology. Part II. Wellington. Government Printer.

Biggs, B. 1966. Maori Myths and Traditions. in A.H. McKlintock (ed), An Encyclopedia of New Zealand. Vol:II, pp.447-454. Wellington. Collins.

1994. Does Maori have a Closest Relative? in D. Sutton (ed). The Origins of the New Zealanders. Auckland. Auckland University Press, pp. 96-105.

- Bott, E. 1982. Tongan Society at the time of Captain Cook's Visits: Discussions with her Majesty Queen Salote Tupou. Wellington. Polynesian Society Memoir, Vol:44.
- Brown, J. M. 1907. Maori and Polynesian: Their Origin, History and Culture. London. Hutchinson.
- Browne, A.H. 1897. An Account of some early Ancestors of Rarotonga. Journal of the Polynesian Society, 6:1-10.
- Burrows, E.G. 1937. Ethnology of Uvea. Honolulu. Bishop Museum Bulletin 145.
1938. Western Polynesia: A Story in Cultural Deviation. in Ethnological Studies, 7:1-192.
1971. Ethnology of Futuna. Honolulu. Bishop Museum Bulletin 138.
- Burrows, W. 1923. Some Notes And Legends of a South Sea Island. Fakaofo of the Tokelau or Union Group. Journal of the Polynesian Society, 32:143-173.
- Christian, F.W. 1895. Notes on the Marquesas. Journal of the Polynesian Society, 4:187-202.
- Colenso, W. 1868. The Maori Races of New Zealand. in Transactions and Proceedings of the New Zealand Institute, Vol. 1 Essays.
- Collocott, E.E.V. 1924. An Experiment in Tongan History. Journal of the Polynesian Society, 33:166-184.

Cook, J. & J. King, 1784. A Voyage to the Pacific Ocean in the Years 1776, 1777, 1778. London. Strahan.

Cowan, J. 1921. The Patupaiarehe. Notes on Maori Folk-Tales of the Fairy Folk. Journal of the Polynesian Society, 30:96-102, 142-151.

1923. The Story of Niue. Genesis of a South Seas Island. Journal of the Polynesian Society, 32:238-243.

Crouch, T., B. Finney, T. Schroeder, E.D. Stroup, N. Thompson, & E. Yadan, 1991. Multiple Voyaging between Hawai'i and Tahiti, in B. Finney (ed), Voyage of Discovery. Honolulu. University of Hawai'i, pp.VII:1-61.

Danielsson, B. 1967. Kiaora Keneti, in G. Highland et al (eds), Polynesian Culture History. Honolulu. Bishop Museum Special Publication 56, pp.20-46.

Davidson, J. 1984. The Prehistory of New Zealand. Auckland. Longman Paul.

1987. Voyages from Distant Shores: Origins of the Maori, in J. Wilson, (ed), From the Beginning: The Archaeology of the Maori. Auckland. Penguin, pp.27-36.

Denning, G.M. 1962. The Geographical Knowledge of the Polynesians and the Nature of Inter-island Contact, in J. Golson (ed), Polynesian Navigation. A Symposium on Andrew Sharp's Theory of Accidental Voyages. Wellington. The Polynesian Society, pp.102-131.

Dixon, R. B. 1929. The Peopling of the Pacific. Philippine Magazine, 26-4:195-197.

1932. The Problem of the Sweet Potato in Polynesia. American Anthropologist, 34-1:40-66.

1934. The Long Voyages of the Polynesians. Proceedings of the American Philosophic Society, 74-3:167-175.

Doran, E. 1976. Wa, Vinta and Tirimaran, in B. Finney (ed), Pacific Navigation and Voyaging. Wellington. The Polynesian Society, pp.29-46.

Duff, R. 1974. Introduction and Summary, in M.M. Trotter (ed), An Introduction to the Southern Cooks. Christchurch. Canterbury Museum Trust Board Bulletin no:6, pp.9-23.

Elbert, H. S. 1941. Chants and Love Songs of the Marquesas Islands, French Oceania. Journal of the Polynesian Society, 50:53-91.

Elbert, H.S. & T. Monberg, 1965. From The Two Canoes. Honolulu. University of Hawaii Press.

Ella, S. 1896. Settlements of Tahitians and Samoans on Mangareva (Gambier Islands). Journal of the Polynesian Society, 5:237-239.

1899. The War of Tonga and Samoa and The Origin of The Name Malietoa. Journal of the Polynesian Society, 8:231-234.

Ellis, W. 1830. Polynesian Researches. London. Fisher, son and Jackson.

Emory, K.P. 1938. The Tahitian Account of Creation. Journal of the Polynesian Society, 47:45-63.

1939. The Tuamotuan Creation Chants. Journal of the Polynesian Society, 42:45-63.

1940. Tuamotuan Concepts of Creation. Journal of the Polynesian Society, 49:69-136.

1942. The Hawaiian God Io. Journal of the Polynesian Society, 51:200-207.

1947. Tuamotuan Religion. Honolulu. Bishop Museum Bulletin 191.

1965. Kapingamarangi: Social and Religious life of a Polynesian Atoll. Honolulu. Bishop Museum Bulletin 228.

1968. Origin of the Hawai'ians. Journal of the Polynesian Society, 77:29-35.

Evenari, G. 1986. Hokule'a: Voyage of Rediscovery, Tonga to Samoa, in C. Sneider & W. Kyselka, The Wayfinding Art. Ocean Voyaging in Polynesia. Berkeley. Regents of The University of California, pp.37-44.

Finney, B. 1967. New Perspectives on Polynesian Voyaging, in G. Highland et al. (eds), Polynesian Culture History. Honolulu. Bishop Museum Special Bulletin 56, pp.141-166.

1975. A Voyage into Hawai'i's Past. Polynesian Voyaging Society News, Aug.

1977. Voyaging Canoes and the Settlement of Polynesia. Science, Vol. 190:4296. Washington Science Institute.

1979. Voyaging. in The Prehistory of Polynesia. J. D. Jennings (ed). Cambridge. Harvard University Press, pp. 323-351.

1986. Relearning a Vanishing Art. Journal of the Polynesian Society, 90:401-405.

1991b. Myth, Experiment and the Re-invention of Polynesian Voyaging. American Anthropologist, 92:183-404.

1994 Experimental Voyaging and Maori Settlement, in D. Sutton (ed), The Origins of the New Zealanders. Auckland. Auckland University Press, pp.52-76.

(ed). 1976. Pacific Navigation and Voyaging. Wellington. The Polynesian Society.

Finney, B., P. Frost, R. Rhodes, & N. Thompson, 1989. Wait for the West Wind. Journal of the Polynesian Society, 98:261-301.

Firth, R. 1954. Anuta and Tikopia: Symbiotic Elements in Social Organisation. Journal of the Polynesian Society, 63:87-131.

1961. The History and Traditions of Tikopia. Wellington. Polynesian Society Memoir 32.

Fletcher, H. 1930. The Use of Genealogies for the Purpose of Dating Polynesian History. Journal of the Polynesian Society, 30:189-194.

Fornander, A. 1878-1885. An Account of the Polynesian Race.
Vols:1-3. London, Trubner.

Frankel, J.P. 1962. Polynesian Navigation. Navigation: Journal
of the Institute of Navigation, 9:35-37.

Fraser, J. 1892. The Samoan Story of Creation. Journal of the
Polynesian Society, 1:164-189.

1895. The Malayo-Polynesian Theory. Journal
of the Polynesian Society, 4:241-255.

1897, 1900. Folk Songs and Myths from Samoa.
Journal of the Polynesian Society, 6:19-36,
67-76, 107-172. 9:9, 126-134.

Freinberg, R. 1989. Possible Prehistoric Contacts Between Anuta
and Tikopia. Journal of the Polynesian
Society, 98:303-317.

Friederici, G. 1914. Malayo-Polynesian Journeying. Leipzig. Von
Simms.

Froiseth, W., C.K. Lindo, N.A. Mower, & P. Theilen, 1984.
History of Hokule'a. in C.K. Lindo & N.A.
Mower (eds), Polynesian Seafaring Heritage.
Honolulu. Kamehameha Schools Press, pp.91-92.

Gatty, H. 1943. The Raft Book. New York. George Grady Press.

1960. Nature is your Guide. London. Collins.

Gifford, E.W. 1924. Tongan Myths and Tales Honolulu. Bishop
Museum Bulletin 8.

1929. Tongan Society. Honolulu. Bishop Museum
Bulletin 61.

- Gill, Rev. W. Wyatt. 1896. Remarks on the Legend of Honoura. Journal of the Polynesian Society, 5:125-127.
- 1911, 1912, 1915. Extracts from Papers of the late Rev.W. Wyatt Gill. Journal of the Polynesian Society, 20:116-117, 122-138, 210-215; 21:39-59, 120-128; 24:140-144.
1915. No Te Kapuaanga O Te Enua Nei Ko Manihiki. The Origins of the Island Manihiki. Journal of the Polynesian Society, 24:144-151.
- Gladwin. T. 1970. East is a Big Bird. Cambridge. Harvard University Press.
- Golson, J. 1962. Polynesian Navigation: A Symposium on Andrew Sharp's Theory of Accidental Voyages. Wellington. The Polynesian Society.
1960. Archaeology, Tradition, and Myth in New Zealand Prehistory. Journal of the Polynesian Society, 69:380-402.
- Graham, G. 1919. The Account of Kupe and Tainui. Journal of the Polynesian Society, 28:111-116.
- Grant, P.J. 1994. Late Holocene Histories of Climate, Geomorphology and Vegetation, in D. Sutton (ed), The Origins of the New Zealanders. Auckland. Auckland University Press, pp.164-194.

Green, R.C. 1981. Location of the Polynesian Homeland: a continuing problem. in J. Hollyman & A. Pawley (eds). Studies in Pacific Languages and Cultures in Honour of Bruce Biggs. Auckland. Auckland Linguistic Society, pp.133-158.

1994. Changes over Time-Recent Advances in Dating Human Colonisation of the Pacific Basin Area, in D. Sutton (ed), The Origins of the New Zealanders. Auckland. Auckland University Press, pp.19-51.

Grey, G. 1854. Polynesian Mythology and the Ancient Traditional History of the New Zealand Race. London. Murray.

Gudgeon, W. 1891. Maori Migrations to New Zealand. Journal of the Polynesian Society, 1:212-232.

1893. The Tangata Whenua; or, Aboriginal People of The Central Districts of The North Island of New Zealand. Journal of the Polynesian Society, 2:203-210.

1902, 1903. The Whence of the Maori. Journal of the Polynesian Society, 11:179-189, 12:51-61, 120-130, 166-179.

Hale, H. 1846. Ethnology and Philology: United States Exploring Expedition. Philadelphia. Sherman.

Handy, E.S.C. 1923. The Native Culture in The Marquesas. Honolulu. Bishop Museum Bulletin 9.

1930. Marquesan Legends. Honolulu. Bishop Museum Bulletin 69.

1971. History and Culture in the Society Islands. Honolulu. Bishop Museum Bulletin 79.

Harlow, R. 1994. Maori Dialectology and the Settlement of New Zealand. in D. Sutton (ed). The Origins of the First New Zealanders. Auckland. Auckland University Press.

Haweti, Tiwini.⁵ 1916, 1917. The Period of Iro-nui-ma-oata and Tangiia-nui-ariki. Journal of the Polynesian Society, 25:131-149; 26:1-18, 45-65.

Henry, Fred. 1993. History of Samoa. Apia. Commercial Printers.

Henry, T. 1893. The Genealogy of the Pomare Family of Tahiti. From the papers of the Rev. J.M. Orsmond. Journal of the Polynesian Society, 2:25-42.

1928. Ancient Tahiti. Honolulu. Bishop Museum Bulletin 48.

Heyen, G.H. 1962. Primitive Navigation in the Pacific-I, in J. Golson (ed), 1962. Polynesian Navigation. A Symposium on Andrew Sharp's Theory of Accidental Voyage. Wellington. The Polynesian Society, pp.64-80.

Heyerdahl, T. 1951. Voyaging Distance and Voyaging Time in Pacific Migration. Geographical Journal, 116:69-77.

1952. American Indians in the Pacific: The Theory behind the Kon-Tiki Expedition. London. Allen and Unwin.

⁵ Also known as Steven Savage.

Highland, G., R. Force, A. Howard, M. Kelly, & Y. Sinoto, 1967. Polynesian Culture History: Essays in Honor of Kenneth P. Emory. Honolulu. Bishop Museum Special Publication 56.

Hilder, B. 1962. Primitive Navigation in the Pacific-II, in J. Golson (ed), Polynesian Navigation. A Symposium on Andrew Sharp's Theory of Accidental Voyage. Wellington. The Polynesian Society, pp.81-95.

Hiroa, Te Rangi.⁶ 1926. The Value of Tradition in Polynesian Research. Journal of the Polynesian Society, 35:181-203.

1932. Ethnology of Tongareva Honolulu. Bishop Museum Bulletin 92.

1932b. Ethnology of Manihiki and Rakahanga Honolulu. Bishop Museum Bulletin 99.

1934. Mangaian Society. Honolulu. Bishop Museum Bulletin 122.

1938. Ethnology of Mangareva. Honolulu. Bishop Museum Bulletin 157.

1938b. Vikings of the Sunrise. New York. Frederick Stokes.

1945. Introduction to Polynesian Anthropology. Honolulu. Bishop Museum Bulletin 187.

⁶ Also known as Peter Buck.

1949. The Coming of the Maori. Wellington. Government Printer.

Holmes, T. 1986. Design of Polynesian Double Canoes, in C. Sneider & W. Kyselka (eds), The Wayfinding Art. Ocean Voyaging in Polynesia. Berkeley. University of California, pp.17-19.

Hornell, J. & A.C. Haddon. 1936-1938. Canoes of Oceania. Vols:1-3. Honolulu. Bishop Museum Special Publications 27, 28, and 29.

Houghton, P. 1980. The First New Zealanders. Auckland. Hodder and Stoughton.

Howard, A. 1967. Polynesian Origins and Migrations: A Review of Two Centuries of Speculation and Theory, in G. Highland et al. (eds), Polynesian Culture History. Honolulu. Bishop Museum Special Publication 56, pp.45-101.

Hunt, B. & M. Kelly. 1984. Double-hulled Canoes of Oceania. in C. Lindo & N. Mower (eds), Polynesian Voyaging Heritage. Honolulu. Kamehameha Schools Press, pp.43-52.

Hutchin, J.J.K. 1904. Traditions and Some Words of the Language of Danger or Pukapuka Island. Journal of the Polynesian Society, 13:173-176.

Ielemia, V. 1983. Fanufuti, in H. Laracy (ed), Tuvalu: A History. Suva. University of The South Pacific, pp.92-96.

Irava, I. 1991. History, Superstition and Religion. in C. Plant (ed), Rotuma. Hanua Pumue: Precious

Land. Suva. Institute of Pacific Studies,
pp.7-15.

Irwin, G. 1980. The Prehistory of Oceania: Colonisation and Cultural Change. in A. Sherratt (ed)). The Cambridge Encyclopedia of Archaeology. Cambridge. Cambridge University Press, pp.324-332.

1981. How Lapita lost its Pots: The Question of Continuity in the Colonisation of Polynesia. Journal of the Polynesian Society, 90:481-494.

1989. Against, Across and Down the Wind: A Case for the Systematic Exploration of the Remote Pacific Islands. Journal of the Polynesian Society, 98:167-206.

1992. The Prehistoric Exploration and Colonisation of the Pacific. Oakleigh. Cambridge University Press.

Isako, T. 1983. Nanumea, in H. Laracy (ed), Tuvalu: A History. Suva. University of The South Pacific, pp.48-57.

Kane, H.K. 1984. Voyage. The Discovery of Hawai'i. Honolulu. Island Heritage.

1984b. Ships with Souls, in C. Lindo & N. Mower (eds), Polynesian Seafaring Heritage. Honolulu. Kamehameha Schools Press, pp.38-40, 55-59.

Keene, F. 1988. Tai Tokerau. Whangarei. Allied.

- Kennedy, D.G. 1929, 1930, 1931, 1932. Field Notes on the Culture of Vaitupu, Ellice Islands. Journal of the Polynesian Society, 38:81-38, 39-70, 71-99; 39:101-124, 125-152, 153-182; 40:217-246, 247-264, 265-284, 285-319; 41:321-326. Wellington.
- Kelly, L.G. 1955. Cook Island Origin of the Maori. Journal of the Polynesian Society, 64:181-196.
- Kirch, P.V. 1986. Rethinking East Polynesian Prehistory. Journal of the Polynesian Society, 95:9-40.
- Kirch, P.V. & P.H. Rosenthal, 1973. Archaeological Investigation of Anuta, in D. Yen & J. Gordon (eds), Anuta: A Polynesian Outlier in the Solomon Islands. Honolulu. Bishop Museum, pp.25-108.
- Kirch, P.V. & D.E. Yen, 1982. Tikopia: The Prehistory and Ecology of a Polynesian Outlier. Honolulu. Bishop Museum Bulletin 238.
- Krauss, B. 1995. The New Wave, in The Honolulu Advertiser, Sunday 15th January, Honolulu.
- Kyselka, W., W. Knows, & B. Smith 1984. By Stars to Tahiti. in N. Mower & K. Lindo (eds). Polynesian Seafaring Heritage. Honolulu. Kamehameha Schools Press, pp.112-121.
1987. An Ocean in Mind. Honolulu. University of Hawai'i Press.
- Lang, J. D. 1877. Origin and Migration of the Polynesian Nation. London. Sampson.

Laracy, H. (ed). 1983. Tuvalu: A History. Suva. University of The South Pacific.

Lafita, N. 1983. Nukufetau, in H. Laracy (ed), Tuvalu: A History. Suva. University of The South Pacific, pp.86-91.

Lafai, P. 1983. Nanumaga, in H. Laracy (ed), Tuvalu: A History. Suva. University of The South Pacific, pp.66-70.

Large, J.T. 1903. The Aitutaki Version of the Story of Iro. Journal of the Polynesian Society, 12:133-146.

1906. Ruatapu: A Celebrated Maori Ancestor and His Cook Island Descendants. Journal of the Polynesian Society, 15:209-219.

1913. Some Notes on Atiu Island, Cook Group, South Pacific. Journal of the Polynesian Society, 22:67-76.

Laupepa, K. 1983. Vaitupu, in H. Laracy (ed), Tuvalu: A History. Suva. University of The South Pacific, pp.78-85.

Lavondes, H. 1967. Observations on Methods Used in Assembling Oral Traditions in the Marquesas. in G. Highland, et al. (eds), Polynesian Culture History. Honolulu. Bishop Museum Special Publication 56, pp.483-500.

- Law, R.G. 1994. The Likelihood of Multiple Settlement in Eastern Polynesia-A Stochastic Model, in D. Sutton (ed), The Origins of the First New Zealanders. Auckland. Auckland University Press, pp.77-95.
- Levison, M., R.G. Ward, & J.W. Webb, 1976. The Settlement of the Polynesian Outliers: A Computer Simulation, in B. Finney (ed), Pacific Navigation and Voyaging. Wellington. The Polynesian Society, pp.57-70. (Study also published in 1973).
- Lewis, D. 1964. Polynesian Navigational Methods. Journal of the Polynesian Society, 73:364-373.
1966. Stars of the Sea Road. Journal of the Polynesian Society, 75:85-94.
1972. We, the Navigators. Canberra. Australian National University Press.
1976. Hokule'a Follows the Stars to Tahiti. National Geographic, Vol:150:4.
1977. From Maui to Cook. Sydney. Doubleday.
1994. We, the Navigators: The Ancient Art of Landfinding in the Pacific. Honolulu. University of Hawaii Press.
- Lindo, C.K. & Mower, N.A. (eds). 1984. Polynesian Seafaring Heritage. Honolulu. Kamehameha Schools Press.
- Lipman, V. 1986. The Young Man and the Sea, in C. Sneider & W. Kyselka (eds), The Wayfinding Art. Ocean Voyaging in Polynesia. Berkeley, Regents of The University of California, pp.20-22.

- Loeb, E.M. 1926 History and Traditions of Niue. Honolulu. Bishop Museum Bulletin 32.
- Low, D. 1924. Traditions of Aitutaki, Cook Islands. Journal of the Polynesian Society, 43:171-186, 258-266; 44:26-31.
- Louisson, L. 1994. Polynesian Ancestors linked to Japan. in New Zealand Herald, Friday 15th April, Auckland.
- Lyons, C.J. & W.D. Alexander, 1893. The Song of Kualii of Hawaii. Journal of the Polynesian Society, 2:160-178.
- MacGregor, G. 1937. Ethnology of Tokelau Islands. Honolulu. Bishop Museum Bulletin 146.
- Malo, D. 1898, Hawaiian Antiquities. Honolulu. Hawaiian Gazette.
1951. Moolele Hawaii. Honolulu. Gribben.
- Manuiri. 1896. The Story of the Visit of Tonga-iti to Rarotonga. Journal of the Polynesian Society, 5:142-144.
- Marsden, S. 1932. The letters and Journals of Samuel Marsden. edited by J. Elder. Dunedin. Coulls, Somerville Wilkie.
- Martin, Josiah. 1911. Origin of the Name of Tonga Island. Journal of the Polynesian Society, 20:1911.
- McFadgen, B.G. 1994. Coastal Stratigraphic Evidence for Human Settlement, in D. Sutton (ed), The Origins of the New Zealanders. Auckland. Auckland University Press, pp.195-207.

McGlone, M.S., A.J. Anderson, & R.N. Holdaway, 1994. An Ecological Approach to the Settlement of New Zealand, in D. Sutton (ed), The Origins of the New Zealanders. Auckland. Auckland University Press, pp.136-165.

Mead, M. 1930. Social Organization of Manua. Honolulu. Bishop Museum Bulletin 76.

Meleisea, M. 1987. A Short History of Western Samoa. Suva. University of The South Pacific.

Metraux, A. 1937. The Kings of Easter Island. Journal of the Polynesian Society, 46:41-61.

1971. Ethnology of Easter Island. Honolulu. Bishop Museum Bulletin 160.

Monberg, T. 1966. The Religion of Bellona Island: A Study of Beliefs and Rites in the Social Life of Pre-Christian Bellona. Part 1: The Concepts of Supernaturals. Copenhagen. The National Museum of Denmark.

Morgan, L. 1878. Ancient Society. New York. Holt.

Morse, S. 1984. Voyage of Discovery: Hokule'a 85-87, A Cultural, Educational, and Scientific Expedition. Honolulu. Special Events Hawai'i.

Mower, N. 1984. Introduction. in C. K. Lindo & N. A. Mower (eds). 1984. Polynesian Seafaring Heritage. Honolulu. Kamehameha Schools Press, pp.1-10.

Nelson, A. 1991. Nga Waka Maori. Auckland. MacMillan.

Nelson, O.F. 1925. Legends of Samoa. Journal of the Polynesian Society, 34:124-145.

Newell, J.E. 1895. The Legend of the Coming of Nareau from Samoa to Tarawa, and his return to Samoa. Journal of the Polynesian Society, 4:231-235.

1895b. Notes on Rev.J.B. Stair's Paper on "Early Samoan Voyages and Settlement". Journal of the Polynesian Society, 4:238-240.

Ngata, A. 1959. Nga Moteatea (The Songs). Part I. Wellington. The Polynesian Society.

Nia, N. 1983. Niutao, in H. Laracy (ed), Tuvalu: A History. Suva. University of the South Pacific.

Nicholas, H. 1892. Genealogies and Historical Notes from Rarotonga. Journal of the Polynesian Society, 1:20-29.

O'Brien, T. 1983. Genesis, in H. Laracy (ed), Tuvalu: A History. Suva. University of The South Pacific.

Orbell, M. 1975. The Religious Significance of Maori Migration Traditions. Journal of the Polynesian Society, 84:341-347.

1985. Hawaiki: A New Approach to Maori Tradition. Christchurch. Canterbury University Press.

Pape, S. 1983. Nui, in H. Laracy (ed), Tuvalu: A History. Suva. University of The South Pacific.

- Pakoti, J. 1895. The First Inhabitants of Aitutaki: The History of Ru. Journal of the Polynesian Society, 4:59-70. Wellington.
- Parker, R.H. 1974. Survey of the Arametua, in M.M. Trotter (ed). An Introduction to the Southern Cooks. Christchurch. Canterbury Museum Trust Board Bulletin no 6, pp.60-70.
- Parsonson, G.S. 1962. The Settlement of Oceania: An Examination of The Accidental Voyage Theory, in J. Golson, (ed). Polynesian Navigation. A Symposium on Andrew Sharp's Theory of Accidental Voyages. Wellington. The Polynesian Society, pp.11-63.
- Piddington, R. 1956. A Note on the Validity and Significance of Polynesian Traditions. The Journal of the Polynesian Society, 65:200-203.
- Plant, C. (ed). 1977. Rotuma: Hanua Pumue-Precious Land. Suva. Institute of Pacific Studies.
- Priday, H. 1950. A Polynesian Migration Circa 1765. Journal of the Polynesian Society, 59:245-260.
- Pritchard, W. T. 1866. Polynesian reminiscences: or life in the South Pacific. London. Chapman & Hall.
- Roberts, R. 1958. The Children of Kaitu'u. Journal of the Polynesian Society, 67:3-10.
- Robertson, B.W. 1957. The Role of Tribal Tradition in New Zealand Prehistory. Journal of the Polynesian Society, 66:249-263.

1958. The Significance of New Zealand Tribal Tradition. Journal of the Polynesian Society, 67:39-57.

1959. The Evaluation of Maori Tribal Tradition as History. Journal of the Polynesian Society, 68:293-307.

1969. A Culture Nomenclature Based on Tradition. Journal of the Polynesian Society, 78:252-258.

Russell, W.E. 1942. Rotuma: Its History, Traditions and Customs. Journal of the Polynesian Society, 51:229-255.

Salmon, T. 1910. On Ari'is in Tahiti. Journal of the Polynesian Society, 19:39-46.

Scarr, D. 1990. The History of the Pacific Islands. Melbourne. Australian National University.

Shand, A. 1895, 1896, 1897. The Moriori People of the Chatham Islands: Their Traditions and History. Journal of the Polynesian Society, 4:33-46, 89-98, 161-176, 206-225; 5:13-32, 73-91, 131-141, 195-211.

Sharp, A. 1956. Ancient Voyages of the Pacific. Wellington. Polynesian Society Memoir 32.

1959. Maori Genealogies and the 'Fleet'. Journal of the Polynesian Society, 68:12-13.

1966. David Lewis's Experimental Voyage. Journal of the Polynesian Society, 75:231-233.

Schultz, E. 1909. The Samoan Version of The Story of Apakura.
Journal of the Polynesian Society, 18:139-142.

Siers, J. 1977. Taratai: A Pacific Adventure. Wellington. Millwood Press.

Simmons, D. 1976. The Great New Zealand Myth. Wellington. A.H. & A.W. Reed.

Smith, S.P. 1892. Futuna; or, Horne Island and its People.
Journal of the Polynesian Society, 1:33-51.

1892b. Uea; or Wallis Island And Its People.
Journal of the Polynesian Society, 1:107-117.

1897. The First Inhabitants of The Ellice Group. Journal of the Polynesian Society, 6:209-210.

1898. Hawaiki. Wellington. The Polynesian Society.

1902, 1903. Niue Island and its People. Journal of the Polynesian Society, 11:79-106, 163-177, 195-218; 12:1-31, 86-119.

1904. Hawaiki (2nd edition). Wellington. The Polynesian Society.

1910. Hawaiki (3rd edition). Wellington. The Polynesian Society.

1910b. Easter Island (Rapa-nui) and Rapa (Rapa-iti Island). Journal of the Polynesian Society, 19:171-175.

1910c. History and Traditions of the Maoris of the West Coast North Island of New Zealand. Wellington. The Polynesian Society.

1911. A Review of Les Polynesiens Orientaux by Eugene Calliot. Journal of the Polynesian Society, 20:152-154.

1911b. Enua-Manu, The Land of Birds. Journal of the Polynesian Society, 20:159-161.

1913. The Lore of The Whare Wananga or teachings of the Maori College. Part 1. Wellington. Polynesian Society Memoir 3.

1915. The Lore of The Whare Wananga or teachings of the Maori College. Part 2. Wellington. Polynesian Society Memoir 4.

1918. Notes on the Mangareva, or Gambier Group of Islands, Eastern Polynesia. Journal of the Polynesian Society, 27:115-131.

1921. Hawaiki (4th edition). Wellington. The Polynesian Society.

Sneider, C. & Kyselka, W. (eds). 1986. The Wayfinding Art. Ocean Voyaging In Polynesia. Berkeley. Regents of the University of California.

Sorrenson, M.P.K. 1977. The Whence of The Maori: Some Nineteenth Century Exercises in Scientific Method. Journal of the Polynesian Society, 86:449-478.

1979. Maori Origins and Migrations: The Genesis of Some Pakeha Myths and Legends. Auckland. Auckland University Press.
- Spriggs, M. 1984. The Lapita Cultural Complex: Origins, Distribution, Contemporaries and Successors. Journal of Pacific History, 19:202-223.
- Stair, J.B. 1895. Samoa Whence Peopled? Journal of the Polynesian Society, 4:47-58.
- 1895b. Floatsam and Jetsam from the Great Ocean; or, Summary of Early Samoan Voyages and Settlement. Journal of the Polynesian Society, 4:99-131.
1896. Jottings on the Mythology and Spirit Lore of Old Samoa. Journal of the Polynesian Society, 5:34-57.
1898. The Names and Movements of the Heavenly Bodies as looked at from a Samoan point of view. Journal of the Polynesian Society, 7:48-49.
- Stimson, F. 1932. Songs of the Polynesian Navigators. Journal of the Polynesian Society, 41:181-201.
- Stokes, J. 1930. An Evaluation of Early Genealogies Used for Polynesian History. Journal of the Polynesian Society, 39:1-42.
- Suggs, R.C. 1960. The Island Civilisations of Polynesia. New York. Mentor Books.
- Sullivan. L. 1924. Race Types in Polynesia. American Anthropologies, 26:22-26.

Sutton, D. (ed). 1994. The Origins of the First New Zealanders.
Auckland. Auckland University Press.

Sykes, J. 1930. An Evaluation of Early Genealogies used for
Polynesian History. Journal of the Polynesian
Society, 39:1-27.

Te Aia. 1893. Genealogies and Historical Notes from Rarotonga.
Journal of the Polynesian Society, 2:271-279.

Te Arikitarare. 1899, 1981, 1920, 1921. The History and
Traditions of Rarotonga. Journal of the
Polynesian Society, 8:61-88, 171-178; 27:178-
198; 28:55-78, 134-151, 1833-208; 29:1-19,
45-69, 107-127, 165-188; 30:1-15, 53-70, 129-
141; 201-206.

Terrell, J. & M. Langridge, 1988. Von Den Steinen's Marquesan
Myths. Canberra. Target Oceania & The Journal
of Pacific History.

Te Uira, 1928. Tradition and Change. Honolulu. Gribben.

Te Whetu, Karepa. 1893. Te Haerenga Mai o Kupe I Hawaiki/The
Coming of Kupe From Hawaiki to New Zealand.
Journal of the Polynesian Society, 2:147-151.

Thompson, L. 1940. Southern Lau, Fiji: An Ethnography.
Honolulu. Bishop Museum Bulletin 162.

Thompson, B. 1892. The Land of our Origin. (Viti or Fiji).
Journal of the Polynesian Society, 1:143-146.

Tinilau, V. 1983. Nukulaelae, in H. Laracy (ed), Tuvalu: A
History. Suva. University of The South
Pacific.

Tregear, E. 1891. The Maori-Polynesian Comparative Dictionary.
Wellington. Lyon and Blair.

1904. Polynesian Origins. Journal of the
Polynesian Society, 13:105-121.

Trotter, M.M. (ed). 1974. The Prehistory of The Southern Cooks.
Christchurch. Canterbury Museum Trust Board
Bulletin no:6.

Turner, G. 1884. Samoa: A Hundred Years Ago and Long Before.
Suva. Institute of Pacific Studies.

Tutuila. 1892. The Line Islanders. Journal of the Polynesian
Society, 1:263-272.

Wallace, D.B. 1920. Notes on Manihiki Island. Journal of the
Polynesian Society, 29:222-223.

Walker, R. 1976. The Relevance of Maori Myth and Tradition. in
M. King, Te Ao Hurihuri. Auckland. Octopus,
pp.171-184

1990. Ka Whawhai Tonu Matou. Struggle Without
End. Penguin. Auckland.

Walter, R. 1994. The Cook Islands-New Zealand Connection, in
D. Sutton (ed), The Origins of the New
Zealanders. Auckland. Auckland University
Press, pp.220-229.

White, J. 1887. The Ancient History of the Maori: His Mythology
and Traditions. Vol:2. Wellington.
Government Printer.

Wilson, J. (ed). 1987. From The Beginning: The Archaeology of The Maori. Auckland. Penguin.

1990. Place Names of the Ancestors. A Maori Oral History Atlas. Wellington. Government Printing Office.

Williams, J. 1895. The Legend of Honoura. Journal of the Polynesian Society, 4:256-294.

Winiata, M. 1950. Hekenga Nui Mai O Nga Waka. Auckland. Auckland University.

Yen, D. & J. Gordon, (eds). 1973. Anuta: A Polynesian Outlier in the Solomon Islands. Honolulu. Bishop Museum.

Yen, D., P. Kirch, & P. Rosenthal, 1973. Anuta-An Introduction, in D. Yen & J. Gordon (eds), Anuta-A Polynesian Outlier in the Solomon Islands. Honolulu. Bishop Museum, pp.1-8.

Young, B. 1984. The Psychological Effects of Long Ocean Voyages, in C.K. Lindo & N.A. Mower (eds), Polynesian Seafaring Heritage. Honolulu. Kamehameha Schools Press, pp.145-146.

Young, J.L. 1898. The Origin of the Name Tahiti. Journal of the Polynesian Society, 7:109-110.